Draft v5

Preliminary Implementation Topic Team Report On Codes & Standards and Insurance & Liability

August 27, 2004

Implementation Topic Team Mission Statement

The mission of the California Hydrogen Highway Implementation team is to facilitate the timely, safe, and effective deployment of a hydrogen energy infrastructure for transportation and stationary power applications in California by 2010. This mission will be accomplished by supporting the development and uniform implementation of regulations, codes, and standards. In addition, the effective education of legislative officials, permitting officials, and the first responder community will be supported as a key element in meeting this mission goal.

The Implementation team will serve as a body of experts that interacts with and seeks to accommodate the needs of public and private stakeholders, permitting officials, codes and standards development organizations, and industry. The team will also analyze pertinent information and make recommendations to the California Hydrogen Highway Blueprint team to achieve the goal of infrastructure deployment by 2010.

Approach: The Implementation Team has approached its mission from two perspectives that are pursued in parallel. First, the status of Codes and Standards (C/S) for hydrogen fuel infrastructure and the vehicle interface is assessed to identify gaps between what will be required and what is currently available and to develop recommendations on the closure of those gaps. Second, risk assessment and management (RA/M) are addressed to insure that public safety is comprehensively addressed and provided for in established professional practices and Codes and Standards used in the permitting of facilities, equipment and their use.

Scope: The scope covers, as applicable, the systems that produce gaseous hydrogen on-site and/or generate electricity, and the systems that store and dispense gaseous hydrogen, liquid hydrogen, and/or hydrogen blends from the point of supply at the fuelling station property to the filling connector installed onboard the land vehicle and/or an external or internal electrical grid.

Codes & Standards

C/S.1 – Authorities Having Jurisdiction and Model Codes
C/S.2.a – Station Interface
C/S.2.b – Pressure Vessel Code
C/S.2.c – Vehicle Interface
C/S.2.e – Clearance Distances
C/S.2.f – Field Certification

C/S.1
Authorities Having Jurisdiction and Model Codes

Part I. Model Building and Fire Code Adoption Process

Definitions

Standard – Set of technical requirements, usually dealing with safety and performance of an individual subject matter (equipment or installation of equipment) – non-mandatory

Code (Model Code) – Set of broad technical system requirements usually dealing with safety and performance of the overall system. It is suitable for adaptation into law / regulation independent on other codes and/or standards. Incorporates by reference various standards. E.g. ICC Building Code incorporates standards published by 50 different organizations (ASTM, NFPA, UL, etc.). Mandatory when adopted

Regulation – Set of legal requirements to support a Legislative Act or Law combined with technical requirements. May incorporate reference to appropriate codes and standards – mandatory

Law or Legislative Act – Broad set of legal requirements with no technical details on subject matter

Authority Having Jurisdiction (AHJ) - The phrase “authority having jurisdiction,” or its acronym AHJ, is used in code documents in a broad manner, since jurisdictions and approval agencies vary, as do their responsibilities. Where public safety is primary, the authority having jurisdiction may be a federal, state, local, or other regional department or individual such as a fire chief; fire marshal; chief of a fire prevention bureau, labor department, or health department; building official; electrical inspector; or others having statutory authority. For insurance purposes, an insurance inspection department, rating bureau, or other insurance company representative may be the authority having jurisdiction. In many circumstances, the property owner or his or her designated agent assumes the role of the authority having jurisdiction; at government installations, the commanding officer or departmental official may be the authority having jurisdiction. AHJ typically works to a Regulation, Code or Standard. In the absence of locally recognized codes a precedent is usually sought either from a similar application or a document used by another jurisdiction.

National Level

Model building and fire codes are largely dependent on the standards development process. Standards Development Organizations (SDOs) are organizations that represent specific as well as varied interests across a multitude of technical and engineering disciplines. These technical and engineering disciplines encompass most

every facet of the modern manufacturing, installation, construction, operation, and maintenance industries, from residential home construction to the manufacturing of automobiles to the operation of large central power generating facilities.

The following is a list of SDOs which primarily operate at the national level:

- API American Petroleum Institute
- ASME American Society of Mechanical Engineers
- CGA Compressed Gas Association
- CSA/ANSI CSA America/American National Standards Institute
- IEEE Institute of Electrical and Electronic Engineers
- NFPA National Fire protection Association (Note: NFPA develops both standards and model codes)
- NIST National Institute of Standards and Testing
- SAE Society of Automotive Engineers
- UL Underwriters Laboratory

This list is by no means exhaustive, merely a representation of a sample group of SDOs that are accredited as such by American National Standards Institute (ANSI) and create national standards for their respective industries and markets. This particular list represents the key SDOs that are involved in the establishment of the appropriate standards for hydrogen energy stations including hydrogen refueling. Some SDOs function on an international level, namely the International Organization for Standardization, drafting standards from a broad base of input, which may also be adopted by a given jurisdiction.

Standards can be generally defined as a set of criteria and/or requirements by which an object or process is measured and/or described. The application of standards from the perspective of conformity provides a means by determining what a particular object or process is, and is universally accepted as such. For example, the sizing of the nozzle that dispenses gasoline to an automobile conforms to the appropriate standard, and may be universally applicable to all gasoline refueling stations to insure interoperability among different manufacturers' vehicles. The same standard may guide automobile manufacturers to follow fueling recepticle design criteria, further increasing a level of public confidence that every gasoline refueling station will accommodate their automobile refueling needs.

The SDOs are voluntary organizations typically representing a particular industry (e.g. Society of Automotive Engineers) or a particular technical and/or engineering discipline (e.g. American Society of Mechanical Engineers). SDOs come together to review and update existing standards on a regular basis or address a particular issue based upon a request for action concerning a particular standard, or that of a new or needed application. Upon final approval the standard is published for reference or regulatory adoption. The request for action can be initiated by most any entity that has an expressed interest in the particular standard. The typical process for updating or establishing new standards is as follows:

- Initiate standards action through request submittal.
- Perform necessary and appropriate technical work through research and analysis.

- Draft updated standard (or new standard) based upon outcome of technical work.
- Distribute to appropriate committees and working groups for review and comment.
- Achieve consensus and obtain required approvals to move forward.
- Conduct public review process for additional review and comment.
- Achieve consensus and obtain approval from supervisory board.
- Obtain ANSI approval of finalized standard.
- Publish for adoption into model codes and regulations as appropriate and applicable.

Availability of developed standards allows the model building and fire code process to begin by reviewing the published standards and updating or developing model codes as necessary and appropriate. Generally speaking, all model codes reference consensus national standards as published by the SDOs. Code Development Organizations (CDOs) are organizations that develop, publish, and own the copyrights to the model codes under their purview. These model codes are typically categorized into the following areas (including but not limited to):

- Building Codes
- Mechanical Codes
- Plumbing Codes
- Electrical Codes
- Fire Codes
- Fuel Gas Codes

These codes establish the minimum standards by which buildings and structures are designed, built and constructed.

The two predominant CDOs that are active in the development of model codes in the United States are the National Fire Protection Association (NFPA) and the International Code Council (ICC). The ICC has copyright ownership to the International Building Code (IBC), the International Fire Code (IFC), International Mechanical Code, International Fuel Gas Code and International Electrical Code, to name a few. The NFPA has copyright ownership to the Uniform Fire Code (NFPA 1), the National Electric Code, and the Uniform Building Code (represented as NFPA 5000), to name a few.

The typical process for updating or establishing new codes is as follows:

- Initiate code action through request submittal.
- Publication, review, and public discussion by the appropriate technical committee.
- Public hearings and voting by the technical committees to either move the code change forward, modify, or reject.
- Publication, review, and public discussion by the larger assembly or entire association.
- Public hearings and voting by the larger assembly or entire association to either recommend code change for approval, modify, or reject.
- Authorizing body (e.g. Standards Council for NFPA, Governmental Member Representatives for ICC) finalizes and publishes new codes for adoption by public and governmental AHJs.

The NFPA has a process for amending and creating documents that very closely mirrors the process for amending and creating state and federal regulations. State and federal agencies use a process that typically has two basic steps: and NPRM (Notice of Proposed Rule Making), a period where comments are reviewed, and FR (Final Rule). NFPA uses the ROP (Report on Proposals) where public proposals have been solicited and reviewed by the technical committee responsible for the document being revised or created, a public comment period on proposals, and ROC (Report on Comments) where public comments are reviewed. All ROP and ROC material is published on the NFPA web site for public access and anyone can submit proposals and comments. All NFPA Technical Committee meetings are open to the public.

NFPA publishes codes, standards, and recommended practices that cover both broad subject matter areas and fairly specific areas. All NFPA documents are ANSI Approved. An example of a code that covers broad subject matter is the National Electric Code, and a standard that covers broad subject matter is NFPA 13 Sprinkler Standard. An example of a code that has a relatively narrow focus is NFPA 30A Code for Motor Fuel Dispensing Facilities and Repair Garages and a standard that has relatively narrow focus is NFPA 50A Standard for Gaseous Hydrogen Storage Systems at Consumer Sites.

Revision cycles for codes and standards are dependent on each organizations revision policy and protocol. There is a connection between codes and standards, since codes reference standards from a foundational perspective (as well as referencing other codes). However, this does not necessarily imply that the revision schedules between the SDOs and CDOs are linked, and cycle conflicts can cause delays in updating and revising codes and standards.

The revision cycle for the two predominant CDOs is as follows:

Revision Cycle		
	NFPA	ICC
Number of Codes	320 Codes and Standards	14 Codes
Comments	255 committees process the codes and standards.	References Standards within its codes.
Revision Cycle	2 year running process, continuously running, staggered by 6 months. Revision cycles vary between 3 to 5 years.	18 month process. New edition printed every 3 years, supplemental printed every 18 months.
Comments	Approximately 30 documents are considered at each spring and fall meeting.	All codes are on the same revision cycle and are discussed and voted on at the same location.

Federal Agencies and Departments are encouraged to consult with and participate in voluntary consensus bodies (which the SDOs and CDOs typically are) developing technical standards for the various business sectors and areas of public safety interests as pertinent to their authority and jurisdiction. Federal Agencies and Departments are

generally required to use these technical standards where applicable and without an otherwise specifically designated standard in effect. These standards are also typically adopted into the Federal Codes and Regulations for promulgation and enforcement.

State Governmental Level

States have the right, as granted by the U.S. Constitution, to legislate for the protection of public health, safety and welfare. This right conveys powers to the legislature of each state to pass laws such as health and safety codes and to establish state agencies that enact and enforce these laws. States, in turn, may delegate some of these powers to local government authorities who then exercise these powers through the administration and enforcement of the applicable laws and codes governing structures and premises.

In the state of California, building and fire codes and regulations are promulgated from mandates in statute, which are defined in the Health and Safety Code. The legislature affects changes in the Health and Safety Code that then directs the relevant state regulatory agencies to adopt new codes and standards or modifications to codes and standards. The adopting agency for building and fire codes is the California Building Standards Commission (CBSC). The proposing agencies, which comprise the Coordinating Council, are the State Fire Marshall (SFM), the Division of the State Architect (DSA), the Housing and Community Development organization (HCD), and the Office of Statewide Health, Planning, and Development (OSHPD). These agencies (state AHJs) submit recommendations and proposals to the CBSC for adoption of building and fire codes and regulations as well as play a regulatory enforcement role.

Regulations relating to applications under the Health and Safety Code are often set forth in the California Business and Professions Code as well.

Other relevant state agencies that provide input into the code adoption process, as well as administer and enforce building, fire, and other applicable codes are listed below:

- CalOSHA — California Occupational Safety and Health Agency
- Weights & Measures — Unit within the Department of Food and Ag
- CalEPA — California Environmental Protection Agency
- DOSH — Department of Occupational Safety and Health
- CPUC — California Public Utilities Commission
- CARB — California Air Resources Board
- CEC — California Electrical Commission

Through a rulemaking process (which typically occurs on an as-needed basis) the Coordinating Council reviews and checks regulations being proposed by any of the individual proposing agencies. Coordination is required so as to ensure that one set of proposed regulations (adoption of new or modified codes, etc.) to not conflict with either statute or mandates of another enforcement agency.

From an industry perspective, the adoption and promulgation of new codes and/or regulations can be conducted in one of two ways: through the passage of enabling legislation, or by petitioning the governing state agency for the respective codes and regulations being enforced (SFM for the fire codes, for example).

Local Governmental Level

The adoption and promulgation of building and fire codes and regulations at the state level is predicated on the premise of local governmental control. Building and fire codes and regulations adopted and promulgated at the state level establish a minimum level of fire/life/safety standards and protections. Local governmental administrative and enforcement agencies (local AHJs) may exceed these minimums through local ordinances, but must maintain the minimums established by the state. Local governmental administrative and enforcement agencies may modify state adopted building and fire codes and regulations if deemed necessary, although each modification must be justified based on one of three applicable criteria: geological, topographical, or meteorological. Approval of justifications for modifying codes and regulations must come from the applicable state agency (e.g. if modifications affect fire/life/safety issues, the approval must come from the SFM). Amendments to codes and regulations are adopted by reference by ordinance. The local legislative body (city council, county supervisors, etc.) reviews, discuss, and vote on ordinances as proposed by [?].

The two predominant local AHJs that would be involved in the siting, design, construction and operation of a hydrogen energy station for transportation and stationary applications are the local building and permitting officials, and the local fire marshal or official. In some smaller jurisdictions, the local fire official also acts as the building official. In some jurisdictions, depending on the type of permit being issued, the local legislative body may be required to take some level of action in order for the permit to be approved.

In the event that a developer or owner believes that the local AHJ is incorrectly applying a building or fire code or regulation, or is misinterpreting an existing code or regulation, or is referencing an inappropriate code or standard in the event that a specific code or regulation does not exist for the particular application, an appeals process exists to allow for the developer or builder to submit their complaint or grievance to the appropriate state AHJ.

NOTE: Specific process and timelines for appeals process not fully understood. Could use some additional information here. Likely different for each state agency

Part II. California Laws and Regulations Relating to Hydrogen Fueling Stations

Current California Laws and Regulations Relating to Hydrogen Fueling Stations

California Regulation	Application	State Agency(s)	Authority Having Jurisdiction	Enforcement	Model Code or Civil Law Referenced	Locally Recognized Standards[1]	Additional CA Statutory Requirements
	Overall Siting, Setbacks, and the Built Environment						
Title 24, Part 2 (1 & 2) – California Building Code	Seismic standards, materials selection, and energy efficiency of commercial structures	OSFM[2], DSA, OSHPD, HCD	Local fire department (sometimes building)	Permitted and reviewed prior to construction	1997 Uniform Building Code		
Title 24, Part 9 Article 52 - Motor Vehicle Fuel Dispensing Stations	Complete installation, equipment assemblies, individual appliances, and setbacks	OSFM, DSA, OSHPD, HCD	Local fire chief	Permitted and reviewed prior to construction (CFC Section 105, Permit m.3)	2000 Uniform Fire Code (UFC)	NFPA 30A NFPA 52 NFPA 50A/B	*5201.5.1 protection of dispensers installed at grade with provisions for point-of-sale device access in accordance with ADA.
Title 24, Part 9, (California Fire Code 2001) Article 29 – Repair Garages, Section 2903 - Repair Garages for Natural Gas and Hydrogen-Fueled Vehicle	Provided here for reference.	OSFM, DSA, OSHPD, HCD	Local fire chief	Permitted and reviewed prior to construction (CFC Section 105.8, Permit r.3)	2000 Uniform Fire Code (UFC)	NFPA 88B	
Title 8, Division 1, Chapter 4 – Division of Industrial Safety, Subchapter 7 - General Industry Safety Orders (especially Article 138,	Minimum standards for safety orders for all places of employment in California including special provisions for certain employment environments,	DOSH	CalOSHA (& DOSH Pressure Vessel Unit in cases of hydrogen storage)	Same as above for all Title 8, Division 1 enforcement	*ASME BPV Code, B31.3 **Various NFPA (inc. NFPA 50, 496) ***API	Note - DOSH/ CalOSHA authority may supercede local authority at places of employment,	Same as above for all Title 8, Division 1 variances

[1] Nationally recognized standards, like NFPA standards, may be used in subject areas not regulated by Title 24, Part 9 (See CFC Section 101.3).
[2] See list of acronyms used at bottom.

"Hydrogen", Sections 5465-5498)	applications, and equipment (including signage, setbacks, materials, design, etc.)				Standard 620 ****CGA Pamphlet S-1 *****Some UL	in some areas	
California Regulation	**Application**	**State Agency(s)**	**Authority Having Jurisdiction**	**Enforcement**	**Model Code or Civil Law Referenced**	**Locally Recognized Standards**	**Additional CA Statutory Requirements**
	Subsystems and Assemblies						
Title 24, Part 3 – California Electrical Code	Wiring, lighting in classified areas	OSFM, DSA, OSHPD, HCD	Local building & fire departments	Permitted and reviewed prior to construction	1999 National Electrical Code (NFPA 70)		
Title 24, Part 4 – California Mechanical Code	Heating, ventilation, and cooling systems (and other heating appliances)	OSFM, DSA, OSHPD, HCD	Local building & fire departments	Permitted and reviewed prior to construction	2000 Uniform Mechanical Code of IAPMO		
Title 8, Division 1, Chapter 4 – Division of Industrial Safety, Subchapters 4 & 5 – for Construction and Electrical Safety Orders	Construction and electrical safety minimum state standards for places of employment	DOSH	CalOSHA	Same as above for all Title 8, Division 1 enforcement	*NFPA (inc. NFPA 30, 70) **Some UL	See note above for Title 8, Division 1	Same as above for all Title 8, Division 1 variances
	Fuel Storage, Piping, and Handling						
Title 24, Part 9 Article 74 - Compressed Gases	Handling, storage, dispensing of compressed hydrogen	OSFM, DSA, OSHPD, HCD	Local fire chief	Permitted and reviewed prior to construction (CFC Section 105, Permit c.7)	2000 Uniform Fire Code (UFC)	NFPA 50A	
Title 24, Part 9 Article 75 - Cryogenic Fluids	Handling, storage, dispensing of cryogenic liquid hydrogen	OSFM, DSA, OSHPD, HCD	Local fire chief	Permitted and reviewed prior to construction (CFC Section 105, Permit c.9)	2000 Uniform Fire Code (UFC)	NFPA 50B	
Title 24, Part 9 Article 80 - Hazardous Materials	Handling, storage, dispensing of hydrogen	OSFM, DSA, OSHPD,	Local fire chief	Permitted and reviewed prior to construction (CFC Section 105,	2000 Uniform Fire Code (UFC)		**California Health and Safety Code* Requirements for

		HCD		Permit h.1)			HMMP and HMIS (see below) **8003.1.4.2 – No emergency ventilation system shutoff required for exhaust systems venting flammable gases completely exhausted to outside air
California Regulation	**Application**	**State Agency(s)**	**Authority Having Jurisdiction**	**Enforcement**	**Model Code or Civil Law Referenced**	**Locally Recognized Standards**	**Additional CA Statutory Requirements**
	Fuel Storage, Piping, and Handling (continued)						
Title 8, Division 1, Chapter 4 – Division of Industrial Safety, Subchapter 1 – Unfired Pressure Vessel Safety Orders (especially Section 460)	High pressure or cryogenic storage and piping requirements for the human interactive employee working environment; Hydrogen storage and piping	DOSH	CalOSHA (& DOSH Pressure Vessel Unit)	Compliance incumbent upon employer/owner, CalOSHA will inspect if found to be out of compliance	*ASME BPV Code, B31.3 **NFPA 58, NFPA Pamphlet 59A ***Some UL	See note above for Title 8, Division 1	Title 8, Division 1, Chapter 3.3 & 3.5 – Occupational Safety and Health Appeals & Standards Boards – for temporary and permanent variances
Title 8, Division 1, Chapter 4 – Division of Industrial Safety, Subchapter 2 – Boiler and Fired Pressure Vessel Safety Orders	Any boiler or fired pressure vessels in the human interactive working environment	DOSH	CalOSHA (& DOSH Pressure Vessel Unit)	Same as above for all Title 8, Division 1 enforcement	*ASME BPV Code, ASME B31.3	See note above for Title 8, Division 1	Same as above for all Title 8, Division 1 variances
Title 19, Division 2, Chapter 4 – Hazardous Material Release	Any storage, use, or handling of hazardous materials	OES, UPS	*Local Fire Dept. **Local CUPA	*Annual resubmission **Requirements include an HMBP with HMMP,	*California Health and Safety Code		

Reporting, Inventory, and Response Plans Especially Section 2720				HPIS and emergency response plan	(Chapter 6.95, Article 1) **Also CFC Article 80		
California Regulation	**Application**	**State Agency(s)**	**Authority Having Jurisdiction**	**Enforcement**	**Model Code or Civil Law Referenced**	**Locally Recognized Standards**	**Additional CA Statutory Requirements**
	Fuel Storage, Piping, and Handling (continued)						
Title 19, Division 2, Chapter 4.5 – California Accidental Release Prevention (CalARP) Program Detailed Analysis	Hydrogen storage greater than 10,000 pounds (4,536 kg or 16,879 gallons, specific gravity for LH2 = .071)	OES, UPS	*Local Fire Dept. **Local CUPA	*Annual resubmission **Requires include a RMP and PHA	Federal Risk Management Program		
	Environmental Impact						
Title 14, Division6, Chapter 3 – Guidelines for Implementation of the California Environmental Quality Act	Environmental impact (especially reformation stations) – air emissions, power consumption	Resources Agency	Local planning departments, local AQMD often involved	Required in local permitting process (could result in conditional approval or EIR)	Unique to California Law		
California Health and Safety Code, Section 40000 – APCD/AQMD authority to permit stationary sources	APCD's/AQMD's have authority in California to regulate and permit stationary sources contributing to criteria pollutants in pursuit of each district's Attainment Plan.		Local APCD or AQMD	Permits and programs may vary between APCD's/AQMD's.	Federal Clean Air Act.		
Title 17, Division 1, Chapter 1.8, Article 3 - Distributed Generation Certification Program	Distributed generation emissions sources below local AQMD deminimus for permitting	CARB	CARB	BACT requirement, only listed technologies accepted	California State Senate Bill 1298		

California Regulation	Application	State Agency(s)	Authority Having Jurisdiction	Enforcement	Model Code or Civil Law Referenced	Locally Recognized Standards	Additional CA Statutory Requirements
	Fueling Interface, Dispenser, and Access						
Title 4, Division 9	*Mass Flow Meters for CNG (Section 337) **Cryogenic materials metering (Section 334) ***Article 2.2 – Electric Watt-hour metering for sub-metering only (attached for reference only) ****General Code 1.10 for device identification and all areas unaddressed by the individual codes	W&M (under Dept. of Agriculture)	Periodic inspections supposed to be carried out by county officials (typically under local agricultural Commissioner)	*Proactive: lists for type approved devices and installations (under NIST) **Periodic inspection following installation ***Annual inspection for cryogenic meters	*National Conference on Weights and Measures (NCWM) Publication 14 **National Institute of Standards and Testing (NIST) Handbook 44		*An CA listed Authorized Service Agency can place the device in service directly upon installation
California Business and Professions Code, Chapter 14 – Weights & Measures, Petroleum Products (starting at 13400)	Provided here for reference only: W&M has purview of quality verification of all vehicle fuels used in spark-fired or compression engines	W&M (under Dept. of Agriculture)	W&M	Random surveys of fuel stations or inspections conducted upon complaint	ASTM and SAE standards for fuel quality testing		
California Business and Professions Code Section 13660 (some references in Title 24, see CFC/Article 52 above)	User assistance for refueling service, signage requirements, and	DAS	*Local officials (varies) **US Department of Justice (at federal level in case of non-compliance)	*Local officials (on a building permit checklist for instance), county sealers **Department of Fair Employment and Housing (DFEH) [if notified of non-compliance]	*American Disabilities Act (ADA) **American Disabilities Act Access Guidelines (ADAAG) [Federal Building Code]		*Threshold for service (DMV placard), signage requirements, and local enforcement. ** Unruh Civil Rights Act (Civil Code Section 54 Government Code 11.135)

California Regulation	Application	State Agency(s)	Authority Having Jurisdiction	Enforcement	Model Code or Civil Law Referenced	Locally Recognized Standards	Additional CA Statutory Requirements
	Fueling Interface, Dispenser, and Access (continued)						
Title 13, Division 3, Chapter 5, Article 3 – Specifications for Alternative Motor Vehicles Fuels, Section 2292.7: Specifications for Hydrogen	Specifications and test methods for hydrogen fuel	CARB	Local AQMD				
	Utilities Connection						
Rule 21 for most California utilities agencies	Distributed generation grid output	PUC	*Local utilities agency **PUC in matters of dispute	Local utilities agency requirement for electricity application	IEEE and UL standards referenced		

Acronyms:

OSFM – Office of the State Fire Marshal	NFPA – National Fire Protection Agency	DOSH – Department of Occupational Safety & Health
DSA – Department of the State Architect	DAS – Disability Access Section	CalOSHA – California Occupational Safety & Health Agency
W&M – Weights and Measures	PHA – Process Hazard Analysis	HMMP – Hazardous Materials Management Plan
AQMD – Air Quality Management District	EIR – Environmental Impact Report	OSHPD – Office of Statewide Health, Planning & Development
UPS – Unified Program Section	O/M – Operations and Maintenance	ASME – American Society of Mechanical Engineers
DMV – Department of Motor Vehicles	OES – Office of Emergency Services	NIST – National Institute of Standards and Testing
BACT – Best Available Control Technology	RMP – Risk Management Plan	HMIS – Hazardous Materials Inventory Statement
PUC – Public Utilities Commission	UL – Underwriter Laboratories	IEEE – Institute of Electrical and Electronics Engineers
APCD – Air Pollution Control District	CARB – California Air Resources Board	HCD – Housing and Community Development
HMBP – Hazardous Materials Business Plan	CFC – California Fire Code	CUPA – Certified Unified Program Agency
IAPMO – International Association of Plumbing and Mechanical Officials		

Sections remaining in earlier draft form.

Current Status of Model Building Code and Fire Code Adoption.

Currently Applicable Codes:

Uniform Building Code	1997 edition
Uniform Fire Code	2000 edition

State Fire Marshall's Office has recommended the National Fire Protection Association (NFPA) 1 for adoption as California's model fire code.

State Architect has recommended the IBC for adoption as the model building code.

NFPA 1 has not been officially adopted by the CBSC as the model fire code for California (same for the IBC). Current estimate for the adoption of NFPA 1 by the CBSC is anticipated to be sometime in October 2007 at the earliest. The adoption of NFPA 1 has been held up pending a legal opinion regarding the need to obtain permission from copyright holders of source material used in the draft documents.

NFPA 5000 is not necessarily accepted for use by the "building industry". Greater than 90% of the comments received by the CBSC from the building industry have been supportive of the IBC as a model building code over utilizing the NFPA 5000. However, the CBSC decided to adopt the 2006 edition of NFPA 5000.

NFPA 1 and NFPA 5000 were originally selected by the California Building Standards Commission as part of the Comprehensive Consensus Codes (C3), a s set is being developed through a partnership involving NFPA, the International Association of Plumbing and Mechanical Officials (IAPMO), Western Fire Chiefs Association (WFCA), and the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE). The first of its kind, C3 is the result of model code developers bringing their expertise together to form one fully integrated, consensus-based code set. C3 offers the only complete set of ANSI-approved model codes.

The NFPA 5000 Building and Construction Safety Code is similar to the International Building Code (IBC).

The International Code Council (ICC) has copyrights to the IBC and International Fire Code (IFC).

The fire industry is divided over the issue of adoption of NFPA 1 as a model fire code.

The recommendation for the purpose of determining which model fire code is and will be applicable to the installation and permitting of hydrogen refueling stations is to utilize the 2000 edition of the UFC as current codes but to look at NFPA 1 and determine whether or not there are differences or "gaps" in comparing the two model codes.

Part III. Obtaining regulatory approvals for a Hydrogen Energy Station – Permitting Process

The general design approach to a hydrogen energy station for transportation and stationary applications falls into five categories:

1. Fuel Supply and Storage
2. General Station Siting Issues
3. Fueling Station Piping and Equipment
4. Fire Protection
5. Operations and Maintenance.

From the perspective of constructing a hydrogen energy station, the general construction activities fall into five categories as well:

1. Selection and preparation of the site
2. Permitting process
3. Siting of system and equipment
4. Storage system
5. Dispensing system.

Between these five design and five construction categories, the permitting process can become a critical path issue for getting a construction project started and completed on schedule, and is the one project variable that can change from jurisdiction to jurisdiction.

The permitting process is comprised of a series of reviews by various permitting and regulatory agencies conducted in order to ensure that the building or structure (occupied space) meets all required and applicable municipal (city, county, or city and county) and state regulations, codes and standards. The purpose of the permitting process is to ensure that buildings and structures are designed and constructed to minimum standards to safeguard life, health, property, and the general welfare of the public. Permitting and regulatory agencies enforce the required and applicable municipal and state regulations, codes and standards by regulating the design, construction, quality of materials, and use of all buildings and structures under their authority and jurisdiction.

Overview

There are five general topic areas that are covered by the permitting process. The first two topics cover the environmental impacts related to the design, construction, and operation of the proposed building or structure. The California Environmental Quality Act (CEQA) requires an assessment regarding the impacts that a project would have on the surrounding environment, including how the project will comply with environmental regulations in mitigating these impacts. The second topic area focuses on the control of air pollution. The California Air Resources Board (CARB) develops and promulgates regulations that control emissions from any equipment or operation that emits pollutants into the atmosphere. The Air Quality Management Districts (AQMD) enforce these regulations at the local level, and can enact stricter regulations as approved by local ordinance.

Of the next three topic areas, the first two depend upon the local requirements for obtaining approval for the installation of a hydrogen refueling station. The local Planning Commission may require review of the proposed project for approval based upon the municipality's general plan and zoning ordinances. More than likely this would also entail a public hearing process. Also, the local legislative authority, such as the city council or county board of supervisors, may require similar treatment and approval

authorization. All projects, however, will be required to proceed with the building permitting process, which is the final topic area in this discussion.

Permitting Sequence

The following chart generally represents the overall sequence of permits needed to establish a hydrogen refueling station:

Phase	Permit Element	Permit	Authorizing Body
Design	Siting	Applicable Approvals	Local Planning Commission, Local Legislative Authority, Planning Department
	Zoning Ordinance		
	Setback Requirements		
	Separation Distances		
	Access Compliance		
	Hydrogen Transport/Delivery		
	Environmental	Compliance	CEQA
Construction Plans and Documents	Emissions	Permit to Construct	AQMD
	Structural	Applicable Permits and Approvals	Building Department
	Mechanical		
	Electrical		
	Plumbing		
	Fuel Gas		
	Architectural		
	Fire/Life/Safety		Fire Department
Construction/Installation	Applicable Inspections		Building Department
			Fire Department
			CalOSHA
			Health Department
Approvals		Permit to Operate	AQMD
			Weights and Measures
Operations		Periodic Inspections	
		Permit Renewals	

Environmental

The CEQA process was put into effect in 1970 for the purpose of monitoring land use and development through the permitting process. The process begins with an evaluation of the proposed project to determine the potential environmental effects. A lead agency must then be identified as the responsible entity which will review the applicant's project information and either approve or deny the permit.

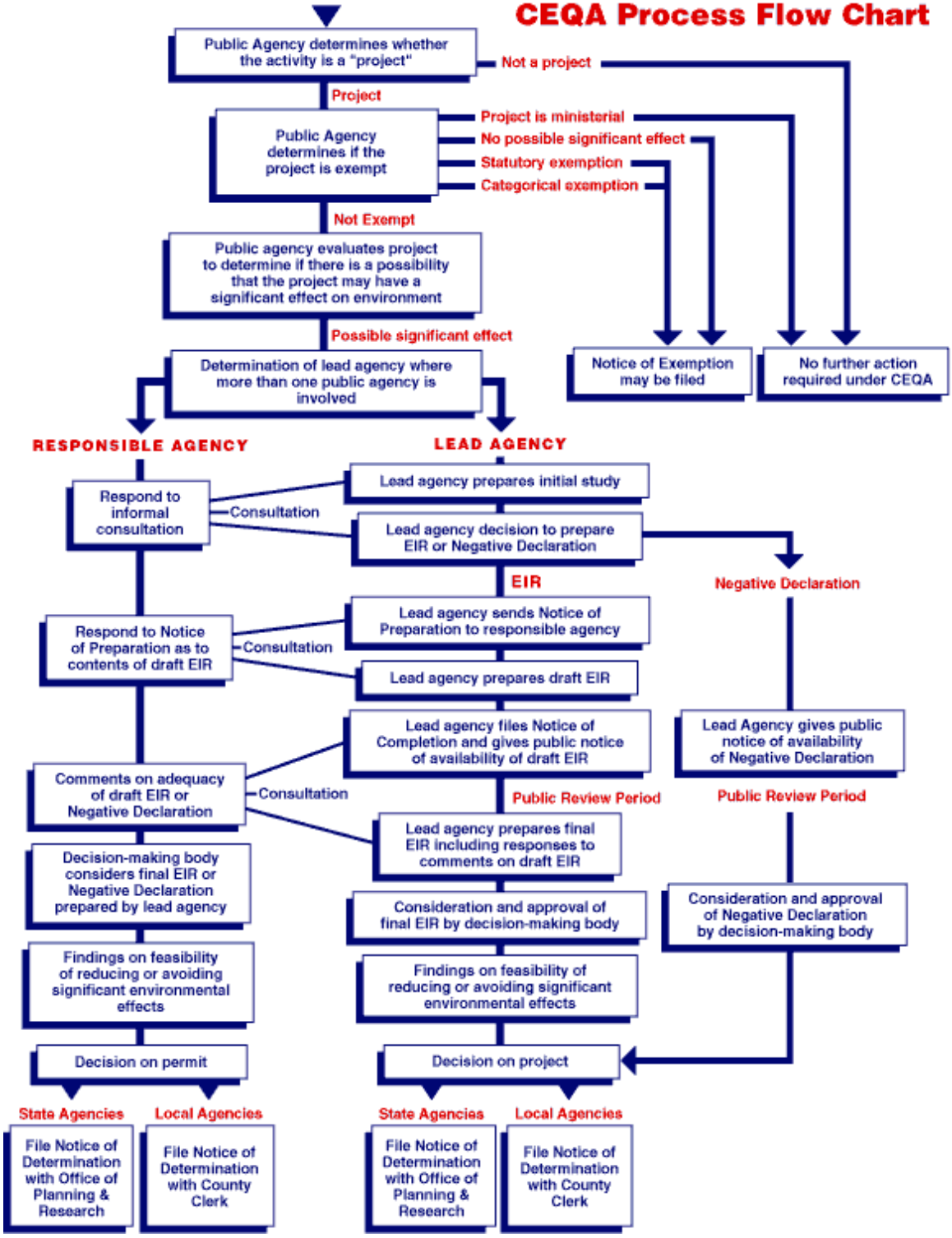
The CEQA permitting process is composed of three main parts: the pre-application phase, the application phase, and the review phase. The flow chart as shown on the next page provides an overview of the CEQA permitting process.

The primary objective of the pre-application phase is to identify the appropriate permitting agencies, determine the lead agency, and ensuring that there is enough relevant project related information to proceed with the determination of the degree of environmental analysis that will be required by the permitting agencies. All relevant permitting agencies other than the lead agency are referred to as the responsible agency.

The application phase consists of the submitting of the necessary permit application forms along with a detailed project description to the lead and responsible agencies. Each agency will review the application to determine completeness of filing.

The lead agency will then determine during the review phase whether or not the proposed project is subject to CEQA. The lead agency may file a Notice of Exemption if the project is not covered by CEQA, or prepare an Initial Study to determine whether or not the project may have significant adverse effects on the environment. If the Initial Study indicates that the project will not have a significant effect on the environment, the lead agency will issue a Negative Declaration. If the Initial Study shows that the project may have one or more adverse environmental effects, the lead agency will circulate a Notice of Preparation which will initiate the development of an Environmental Impact Report (EIR).

Assuming that the environmentally adverse effects can be properly mitigated below a level of significance, and that other factors merit the approval of the project, the lead agency will certify the EIR and issue a Notice of Determination, affectively approving the permit and allowing the project to proceed to the next phase.



From: http://ceres.ca.gov/images/CEQA_process_chart.gif
California Environmental Resources Evaluation System Web Site
California Resources Agency, State of California

Each AQMD in California is authorized by the Health and Safety Code to issue permits for stationary sources that emit pollutants into the atmosphere. There are two permits that are issued by each AQMD: Permit to Construct and a Permit to Operate. The permit process is described below.

AQMD Permit Process

This process should occur as part of the pre-construction process, during the design phase, most likely at the 75% or 90% construction document stage.

- Determine if equipment/project is classified as a minor, moderate, or major source as it relates to the emissions of air pollutants.
    - Sources emitting more than 10 tons per year of an identified hazardous pollutant or 25 tons of a combination of pollutants are classified as major sources. Major sources are required to obtain Title V operating permits.
- Complete and process Permit to Construct application and submit with fee.
    - Business related information (Applicant Information).
    - Equipment and process related information.
    - Emissions related information.
    - CEQA documentation.
- Receipt of application by AQMD.
- Review for completeness and accuracy.
- Review to determine compliance with AQMD rules, regulations, and policies.
    - Review period typically 49 to 60 days, depending on equipment and process.
- Issuance of Permit to Construct.
- Construction and/or installation of equipment/project.
- AQMD inspection to verify compliance with Permit to Construct. Confirm equipment/project operates in compliance with AQMD rules, regulations and policies.
    - Applicant is required to notify the AQMD prior to initial start-up date of the source. Initial start-up period may last for 60 days, during which the AQMD will evaluate the source for compliance.
- Issuance of Permit to Operate.
    - Permits are valid for one year and must be renewed annually.

Plan Review Phase

There are two basic phases to the building permitting process: plan review and construction inspection. For a motor fuel dispensing facility, a third phase can also be considered regarding operations and maintenance, including training and safety plans. This additional consideration is primarily due to the nature of a motor fuel (in this case hydrogen) dispensing facility and the fact that these facilities retain on site hazardous materials and substances and chemical products.

The plan review phase of the permitting process begins with the submittal of the appropriate documents and applicable fees to the coordinating permitting agency, typically the building and/or planning department of most municipal jurisdictions. At this stage of the permitting process the applicant should have addressed zoning ordinance requirements, setback requirements, separation distances in accordance with the applicable codes and standards, and the method of transport of hydrogen to the site (assuming that hydrogen isn't being generated on site). There are four items that are typically required by most all jurisdictions to initialize this phase, and these would include: assessor tax parcel number (evidence of legal lot), full legal description, site plan drawn to scale, and a good estimate of the total cost of the proposed project.

The primary activity in the plan review phase is the review of the building plans, which can be further delineated into several major permitting categories, with each major permitting category further segmented into sub-categories. The four major permitting categories are: site, building, fire, and environmental. A fifth major category that is related to the permitting of a hydrogen motor fuel dispensing facility is the performance of a Failure Mode and Effect Analysis (FMEA) and Hazard and Operability Study (HAZOP). *[Question: is there a permit issued for the satisfactory performance of a FMEA and HAZOP?]* The following is a listing of the sub-categories for each major permitting category:

Major Category		**Site**	**Building**	**Fire**	**Environmental**
Sub-Category		Demolition	Structural	Fire Protection	CEQA
		Grading	Mechanical	Fire Safety Plan	AQMD
		Excavation	Electrical		Water
		Foundation	Plumbing		Waste
		Street Use	Fuel Gas		
			Architectural		

Table *

The plans and information submitted for review follow the identified permitting categories as listed in the preceding table. The following is a list of plans typically submitted for obtaining approval to proceed to construction:

1. Site Plan
2. Specifications
3. Soils Report
4. Architectural Plans
5. Structural Plans
6. Structural Calculations
7. Life Safety Plans
8. Mechanical Plans
9. Plumbing Plans
10. Fuel Gas Plans
11. Electrical Plans
12. Fire Protection System Plans
13. Fire Protection System Calcs

In addition to the above listed plans and information, the installation of a hydrogen energy station may require submittal of California Code of Regulations Title 24 Part 6 compliance information (energy efficient designs meeting minimum energy standards in accordance with the published regulations). Other information required for submittal may include Access Compliance (in accordance with ADA regulations), and proof of Workers Compensation Insurance. Finally, a State Industrial Safety permit may be required which may require additional information to be submitted for review.

In California, the local Air Quality Management District (AQMD) is an AHJ that regulates emissions from a variety of sources, including motor fuel dispensing facilities. For the installation of a hydrogen energy station, a Permit to Operate most likely will be required to be issued from the local AQMD, as well as an Authority to Construct prior to commencement of construction. Depending on the jurisdiction, approval from the AQMD may be required prior to initiating the plan review phase of the permitting process.

In larger jurisdictions, the plan review process may require the involvement of several municipal regulatory departments. The Planning Department determines the appropriateness of the installation of the project based on the general plan and local governmental policies and regulations. The Building Department handles the bulk of the plan review and inspection responsibilities for the design and installation of building, structure or facility. The Fire Department also has both plan reviewers and field inspectors to ensure that fire/life/safety regulations, codes and standards are being adhered to. The Public Works Department will review the submitted plans and information for street use permits, water and sewer interconnections, and other aspects of the utilization of city services for the construction and operation of the building, structure or facility.

Additional regulatory, code and standard oversight can come from other departments and agencies such as CalOSHA and the Public Health Department. If the building, structure or facility is being constructed in a redevelopment zone, the Redevelopment Agency may require a review of the plans. Also, depending on the nature of the building, structure or facility being constructed, public and neighborhood notifications may be required. In smaller jurisdictions, many of these functions may be handled by fewer departments, agencies and personnel.

For the installation of a hydrogen energy station that will generate electricity and operate in parallel with the local utility grid, the local utility has the regulatory authority to review the interconnection plans, approve to interconnect, inspect the installation, and test the interconnection prior to final approval. Interconnection requirements are typically published in the utility's tariff. In California, for the three large Investor Owned Utilities (IOUs), Rule 21 is the applicable tariff regulation for interconnecting customer owned on site generation.

Construction Inspection

The construction inspection phase is typically coordinated with the construction schedule. As each major milestone in the project is reached, the construction manager schedules an appointment with the inspector to obtain approval for the installation of a particular aspect of the project. The inspector is the field person who ensures that the construction project is being installed as designed and follows the applicable regulations, codes and standards.

Appeals Process

[Discussion on the typical local AHJ appeals process: Planning Commission, Building Inspection Commission, Fire Protection District Board, Access Appeals Commission, etc.]

Inspection and Permit Cycles

[Discussion on generally how often a hydrogen energy station would have to renew the various operating permits, and how often inspections are required]

Approval to Operate

[Discussion regarding obtaining final approvals, filing of any required notices, passing inspection by Weights and Measures, etc.]

Additional Permitting Considerations

Permits may require review and approval from the city council or county board of supervisors, depending on the appropriate jurisdiction. This could add an additional step to the permitting cycle, which would then begin with review and approval by the local governmental planning commission, followed by approval from the local legislative agency (city council, county board of supervisors, etc.), before then proceeding to the approval and permitting process for construction. It should be noted that a conventional fueling station (gasoline, diesel) generally takes 12 to 14 months to get approval for construction.

Other permits that need to be considered or may be required by the local AHJs include: burglar or security alarm permit, air tanks permit, industrial activities storm water general permit, underground storage tank permit, hazardous materials license, hazardous waste generator permit, and on-site hazardous waste treatment permit, as well as the typical business related permits.

Permitting Flow Chart

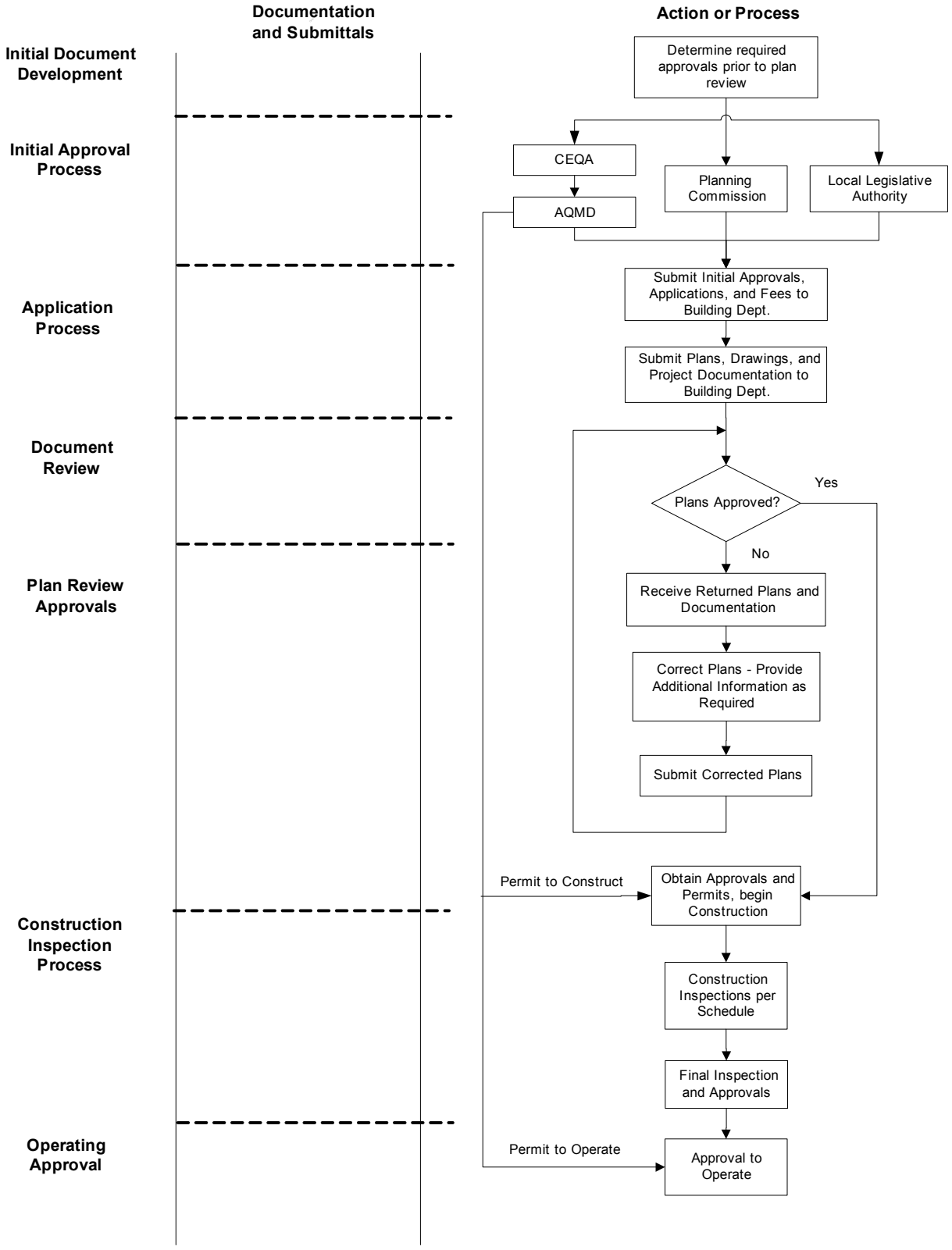
The permitting flow chart generally can be broken down into five basic processes:

1. Application Process
2. Document Review Process
3. Approval Process
4. Construction Inspection Process
5. Operating Approval Process

This list doesn't necessarily imply a linear order and progression for the overall permitting process, since some tasks and activities can be conducted in a parallel manner, while others are on a critical path and must follow one after the other.

[This flow chart is meant as a starting point for discussion. Final flow chart will most likely require review by others for clarity, accuracy, and adequacy.]

Permitting Flow Chart


Documentation and Submittals
Action or Process
Initial Document Development
Initial Approval Process
Application Process
Document Review
Plan Review Approvals
Construction Inspection Process
Operating Approval
Determine required approvals prior to plan review
CEQA
AQMD
Planning Commission
Local Legislative Authority
Submit Initial Approvals, Applications, and Fees to Building Dept.
Submit Plans, Drawings, and Project Documentation to Building Dept.
Plans Approved?
Yes
No
Receive Returned Plans and Documentation
Correct Plans - Provide Additional Information as Required
Submit Corrected Plans
Permit to Construct
Obtain Approvals and Permits, begin Construction
Construction Inspections per Schedule
Final Inspection and Approvals
Permit to Operate
Approval to Operate

Identify gaps for both model codes (NFPA and ICC), current and future.

NOTE: Government of California website provides access to a document produced by the SFM titled "Operation Code Comparison". This document provides information regarding the differences between the 2001 CBC, the 2001 California Fire Code, and the following documents: 2003 Draft IBC, 2003 NFPA 5000, 2003 Draft IFC, and the 2003 Report on Comments (ROC) Draft NFPA 1, Uniform Fire Code. This document should prove to be helpful in identifying the gaps in model codes. This information has not been incorporated into this document, and will refer to the sub-group's consensus on best approach.

Develop recommendations based upon identified gaps for both model codes.

Is legislation actually required, or can AHJs that have regulatory authority develop and promulgate changes in applicable codes unilaterally?

Legislative process vs regulatory process.

Short Term Recommendations

Long Term Recommendations

NOTE: At this time, no recommendations have been discussed by the sub-group. After review, comment, corrections, and revisions have been affected to this document, the hope is that recommendations will be identified and inserted into the final document.

Definitions of acronyms and abbreviations.

References.

NOTE: All materials utilized and referenced in the generation of this document will be listed here.

C/S.2.a
Station Interface Matrix

	Assignments	Rivkin	Rivkin	Rivkin	DeLaura	DeLaura	Chernicoff	Chernicoff	Chernicoff	DeLaura	DeLaura	Chernicoff	Chernicoff	Chernicoff	Keller	Keller	Keller	Keller	Keller	Keller	Pedersen	Pedersen	Pedersen	Pedersen	Boyd	Boyd
	Hydrogen Fueling Station Type	Grounding Grid / Rods	Phone Line or Internet	Low Voltage (Signal)	Medium Voltage single phase (120 / 240 VAC)	High Voltage 3 phase (480 and above)	General Utility Water	DI Water (Filtered)	Fire Protection /Fire Hydrants	Natural Gas by Pipeline (Low Pressure)	Natural Gas by Pipeline (High Pressure)	Storm Drains	Sewer Drains	Special Collection?	Air Intake (cooling only)	Air intake (combustion)	Venting H2	Venting O2	Venting Exhaust (ex. CO2)	Venting air (Not HVAC)	Compressed Air (CA)	Instrument Nitrogen	Pipeline Right of way	Property Land Issues	Road Access/ Traffic	Aesthetics/ special zoning requirements
1	*Onsite Production*	R	O > R	R	R	R	R	N/A	TBD	R	TBD	TBD	TBD	TBD												
1.a.	Onsite Reforming	R	O > R	R	R	R	TBD > R	N/A >R	TBD	R	TBD	TBD	TBD	TBD	TBD	R	R	NA	R	TBD	O	O	R	TBD	O	Site Specific
1.b.	Onsite Electrolyzer	R	O > R	R	R	TBD	R	N/A >R	TBD	TBD > N/A	N/A	TBD	TBD	TBD	TBD	NA	R	R	NA	TBD	O	O	N/A	TBD	O	Site Specific
2	*Delivered Hydrogen*																									
2.a.	Gaseous tube trailer	R	O > R	R	R	O > R	O	N/A	TBD	N/A	N/A	TBD > N/A	TBD	TBD	NA	NA	R	NA	NA	NA	O	O	N/A	TBD	R	Site Specific
2.b.	Liquid Tanker	R	O > R	R	R	R	O > R	N/A	TBD	N/A	N/A	TBD > N/A	TBD	TBD	NA	NA	R	NA	NA	NA	O	O	N/A	TBD	R	Site Specific
2.c.	H2 Pipeline	R	O	R	R	O > R	O	N/A	TBD	N/A	N/A	TBD > N/A	TBD	TBD	NA	NA	R	NA	NA	NA	O	O	R	TBD	O	Site Specific

Legend: R=Required, O=Optional, N/A=Not Applicable, TBD=To Be Determined

Red=H2 Specific
Green=Not H2 Specific

Notes: Responses for Columns E, F, G, K, & L reflect likely technical requirements based on assumptions regarding possible station designs.
These assumptions should be checked against available data from existing H2 stations constructed here in CA and elsewhere.
Low pressure natural gas service at the Liquid Tanker or even the H2 pipeline might be needed depending on the need for heating equipment at the delivery site.
*** why would natual gas be needed to support a Liquid tanker or pipeline installation?

Delivered Hydrogen – Trailer, Tanker, Pipeline

California Regulation[1]	Application	State Agency(s)	Authority Having Jurisdiction	Enforcement	Laws, Codes, or Standards Referenced	Locally Recognized Standards[2]	Additional CA Statutory Requirements
Grounding, Grid, Rods	***Delivered Hydrogen – Trailer, Tanker, Pipeline***						
					All grounding must meet NFPA 70, National Electrical Code®,		
Low Voltage Signal	***Delivered Hydrogen – Trailer, Tanker, Pipeline***						
					"Points where connections are regularly made and disconnected 1 Within 3 ft (1 m) of connection- Class 1 Division 1 Between 3 ft (1 m) and 25 ft (7.6 m) of connection-		

[1] This table is intended to refer to current, as of July 2004, California laws, statutes, or regulations and is in no way intended to be seen as a gap analysis.
[2] Nationally recognized standards, like NFPA standards, may be used in subject areas not addressed by Title 24, Part 9 (See CFC Section 101.3).

					Class I Division 2"		

Medium Voltage Single Phase	***Delivered Hydrogen – Trailer, Tanker, Pipeline***						
Health & Safety Code	Handling of H2	Public Health Dept	Public Health Dept	Public Health Dept			
Title 24 Part 9 Fire Code	Equipment & Piping Compressed gases	OSFM	Local Fire Chief	Permit, Review & Inspection	NFPA 70, 52 ASME, ASTM,	Local City Code	
Title 24 Part 3 Electrical Code	Electric Power	OSFM	Local Bldg Dept	Permit,Review & inspection	NEC, NFPA 70, NFPA52 NEMA, IEEE, UL	Local City Code	
Title 24 Part 9, compressed gases, cryogenic fluids and hazardous materials	Handling, storage and dispensing of H2	OSFM	Local Fire Chief	Inspection	Uniform Fire Code NFPA 54, UL	Cocal Ordinances	

High Voltage Three Phase	***Delivered Hydrogen – Trailer, Tanker, Pipeline***						
Health & Safety Code	Handling of H2	Public Health Dept	Public Health Dept	Public Health Dept			
Title 24 Part 9 Fire Code	Equipment & Piping Compressed gases	OSFM	Local Fire Chief	Permit, Review & Inspection	NFPA 70, 52 ASME, ASTM,	Local City Code	
Title 24 Part 3 Electrical Code	Electric Power	OSFM	Local Bldg Dept	Permit,Review & inspection	NEC, NFPA 70, NFPA52 NEMA, IEEE, UL	Local City Code	
Title 24 Part 2	Seismic Standards	OSFM	Local Bldg Dept Local Fire Chief	Local Bldg Dept inspection	UBC, ASME, ASTM	Local City Code	

Title 24 Part 9, compressed gases, cryogenic fluids and hazardous materials	Handling, storage and dispensing of H2	OSFM	Local Fire Chief	Inspection	Uniform Fire Code, NFPA54, UL	Cocal Ordinances	

Instrument Air / Instrument Nitrogen	***Delivered Hydrogen – Trailer, Tanker, Pipeline***						
TBD	Siting for Air Compressor - Set back distances would need to be followed with respect to the air intake for the compressor and the electrical components /classification.	OSFM	Local Fire Chief / HAZMAT	Permitted and reviewed prior to construction	Uniform Fire Code (UFC)	NFPA 50A NFPA 50B UFC CFC	

On first pass no specific or unique issues pertaining to hydrogen or hydrogen fueling stations were identified other than the item listed above. Good engineering practice, local codes, national recognized standards, etc. should all be followed, but the fact that this is a H2 station should not create any changes in the design, construction, installation, or operation of the station relating to this item. As additional people review the document and new things come to light, this section will be updated.

Instrument or Compressed Air (CA) – Used for valve actuation/air operated valves, electrical panel purge, etc. (CA should not to be used for purging of piping or equipment in hydrogen service. An inert gas such as nitrogen must be used for this.) Assumed source is an air compressor. Typical pressure is 100 to 150 psig.

Instrument N2 – Used for valve actuation/air operated valves, electrical panel purge, piping/equipment purging, etc. Assumed source could be from a liquid nitrogen system, membrane/generator, etc. Typical pressure is 100 to 150 psig.

H2 Gas Pipeline	***Delivered Hydrogen – Trailer, Tanker, Pipeline***						

Property / Land Use / Environmental	***Delivered Hydrogen – Trailer, Tanker, Pipeline***						
California Environmental Quality Act (CEQA)	Project size and location will determine if this applies. Obviously the bigger the project the greater the likelihood of triggering CEQA	Various	Often times if there is a state agency involved, they will take the lead on evaluating the possible CEQA impact. If there is no agency directly involved in the project, then typically it's the agency that's issuing a statewide permit (air pollution, water pollution, etc.) to the project.	Not sure?	Refer to the web site http://ceres.ca.gov/ceqa/	N/A	a) Negative Declaration if it finds no "significant" impacts; b) Mitigated Negative Declaration if it finds "significant" impacts but revises the project to avoid or mitigate those significant impacts; c) Environmental Impact Report (EIR) if it finds "significant" impacts.

California Accidental Release Program (CalARP). (California's answer to RMP)	Applies if storage of 10,000 pounds or more of hydrogen at the site.	CAL EPA?		Not sure?	Refer to website http://www.oes.ca.gov		Includes: Safety information, Hazard review, Operating procedures, Training, Maintenance, Compliance audits, and Incident investigation.
EPA,Risk Management Plan (RMP)	Applies if storage of 10,000 pounds or more of hydrogen at the site.	Not sure?	Federal EPA				
OSHA,Process Safety Management (PSM)	Applies if storage of 10,000 pounds or more of hydrogen at the site.	Not sure?	Federal OSHA				

Road Access to the site / Traffic	***Delivered Hydrogen – Trailer, Tanker, Pipeline***						
	Transporting of flammable liquids or gases – Local regulated roads and bridges.						
	Transporting of flammable liquids or gases – State regulated roads, highways, bridges, tunnels.			California Highway Patrol (CHP)	DOT		

	Assume that delivery vehicle must be on private property when off loading product. Can not be parked on a public street during off loading.						

California Code of Regulations Title 21 Section 1402.1(b) states that tank vehicles which are placarded "Flammable" under Department of Transportation (DOT) Regulations whether loaded or empty are not permitted on the Bay Bridge for example. "FLAMMABLE" is the proper placard for vehicles transporting materials with a hazard class of 3. Liquid Hydrogen has a hazard class of 2.1, the proper placard is "Flammable Gas". Therefore, it is believed that transporting liquid hydrogen across the Bay Bridge is permitted according to these regulations. This is probably an area where help and clarification is needed.

Aesthetics / Special Zoning Requirements	***Delivered Hydrogen – Trailer, Tanker, Pipeline***						

It is believed that this issue will vary quite a bit from city to city, as well as the specific location that the station is at (for example if the area is zoned for commercial, light-industrial, heavy-industrial, etc.). Some cities have specific height restrictions; require screening to hide the equipment, noise restrictions if close to residential areas, etc. These issues are not specific to hydrogen only. This would apply to any industrials tanks, equipment, etc.

When the revised codes such as NFPA and IFC are published they will address underground storage of liquid hydrogen storage tanks as well as gaseous storage and equipment installation on the top of canopies.

On first pass no specific or unique issues pertaining to hydrogen or hydrogen fueling stations were identified. Good engineering practice, local codes, national recognized standards, etc. should all be followed, but the fact that this is a H2 station should not create any changes in the design, construction, installation, or operation of the station relating to this item. As additional people review the document and new things come to light, this section will be updated.

Onsite Production, Reformer, Electrolyzer

California Regulation[3]	Application	State Agency(s)	Authority Having Jurisdiction	Enforcement	Laws, Codes, or Standards Referenced	Locally Recognized Standards[4]	Additional CA Statutory Requirements
Grounding, Grid, Rods	**On Site Production, Reformer, Electrolyzer**						
					All grounding must meet NFPA 70, National Electrical Code®,		
Low Voltage Signal	**On Site Production – Reforming, Electrolyzer**						
					"Points where connections are regularly made and disconnected 1 Within 3 ft (1 m) of connection- Class 1 Division 1 Between 3 ft		

[3] This table is intended to refer to current, as of July 2004, California laws, statutes, or regulations and is in no way intended to be seen as a gap analysis.
[4] Nationally recognized standards, like NFPA standards, may be used in subject areas not addressed by Title 24, Part 9 (See CFC Section 101.3).

					(1 m) and 25 ft (7.6 m) of connection- Class I Division 2"		

Medium Voltage Single Phase	**On Site Production, Reformer, Electrolyzer**						
Health & Safety Code	Handling of H2	Public Health Dept	Public Health Dept	Public Health Dept			
Title 24 Part 9 Fire Code	Equipment & Piping Compressed gases	OSFM	Local Fire Chief	Permit, Review & Inspection	NFPA 70, 52 ASME, ASTM,	Local City Code	
Title 24 Part 3 Electrical Code	Electric Power	OSFM	Local Bldg Dept	Permit,Review & inspection	NEC, NFPA 70, NFPA52 NEMA, IEEE, UL	Local City Code	
Title 24 Part 2	Seismic Standards	OSFM	Local Bldg Dept Local Fire Chief	Local Bldg Dept inspection	UBC, ASME, ASTM	Local City Code	
Title 24 Part 9, compressed gases, cryogenic fluids and hazardous materials	Handling, storage and dispensing of H2	OSFM	Local Fire Chief	Inspection	Uniform Fire Code NFPA 54, UL	Cocal Ordinances	

High Voltage Three Phase	**On Site Production, Reformer, Electrolyzer**						
Health & Safety Code	Handling of H2	Public Health Dept	Public Health Dept	Public Health Dept			

Title 24 Part 9 Fire Code	Equipment & Piping Compressed gases	OSFM	Local Fire Chief	Permit, Review & Inspection	NFPA 70, 52 ASME, ASTM,	Local City Code	
Title 24 Part 3 Electrical Code	Electric Power	OSFM	Local Bldg Dept	Permit,Review & inspection	NEC, NFPA 70, NFPA52 NEMA, IEEE, UL	Local City Code	
Title 24 Part 2	Seismic Standards	OSFM	Local Bldg Dept Local Fire Chief	Local Bldg Dept inspection	UBC, ASME, ASTM	Local City Code	
Title 24 Part 9, compressed gases, cryogenic fluids and hazardous materials	Handling, storage and dispensing of H2	OSFM	Local Fire Chief	Inspection	Uniform Fire Code, NFPA54, UL	Cocal Ordinances	

General Utility	**On Site Production - Reforming , Electrolyzer**						
Health & Safety Code	Handling of H2	Public Health Dept	Public Health Dept	Public Health Dept			
Calif Vehicle Code	Transport			Local Gov, Police, CHP	DOT, EPA		
Title 24 Part 2	Seismic Standards	OSFM	Local Bldg Dept Local Fire Chief	Local Bldg Dept inspection	UBC, ASME, ASTM	Local City Code	
Calif Environ Quality Act -CEQA	EIR		Local Planning Dept	Permitting Process		Local City Planning Guidelines	

Low Pressure Gas Pipieline	**On Site Production, Reformer, Electrolyzer**						
Health & Safety Code	Handling of H2	Public Health Dept	Public Health Dept	Public Health Dept			

Title24 Part 2 Structural	Structural -seismic		Local Bldg Dept	Permit & Review	UBC, ASME, ASTM, MSS		
Title 24 Part 4 Mechanical Code	Piping/HVAC/equipment		Local Bldg Dept	Permit & Review	UMC, NFPA, HI, ASME, SBI, UL, FM, ANSI	Local City Code	
Title 24 Part 5 Plumbing Code	Piping		Local Bldg Dept	Permit & Review	UPC, NFPA, ASME, UL, ANSI	Local City Code	
Title 24 Part 9 Fire Code	Equipment & Piping Compressed gases	OSFM	Local Fire Chief	Permit & Review	NFPA 70, 52, 54, ANSI, ASTM, ASME, UL	Local City Code	
Calif Environ Quality Act -CEQA	EIR		Local Planning Dept	Permitting Process		Local City Planning Guidelines	

High Pressure Gas Pipeline	**On Site Production, Reformer, Electrolyzer**						
Health & Safety Code	Handling of H2	Public Health Dept	Public Health Dept	Public Health Dept			
Title24 Part 2 Structural	Structural -seismic		Local Bldg Dept	Permit & Review	UBC, ASME, ASTM, MSS		
Title 24 Part 4 Mechanical Code	Piping/HVAC/equipment		Local Bldg Dept	Permit & Review	UMC, NFPA, HI, ASME, SBI, UL, FM, ANSI	Local City Code	
Title 24 Part 5 Plumbing Code	Piping		Local Bldg Dept	Permit & Review	UPC, NFPA, ASME, UL, ANSI	Local City Code	
Title 24 Part 9 Fire Code	Equipment & Piping Compressed gases	OSFM	Local Fire Chief	Permit & Review	NFPA 70, 52, 54, ANSI, ASTM, ASME, UL	Local City Code	

Calif Environ Quality Act -CEQA	EIR		Local Planning Dept	Permitting Process		Local City Planning Guidelines	

Instrument Air / Instrument Nitrogen	**On Site Production, Reformer, Electrolyzer**						
TBD	Siting for Air Compressor - Set back distances would need to be followed with respect to the air intake for the compressor and the electrical components /classification.	OSFM	Local Fire Chief / HAZMAT	Permitted and reviewed prior to construction	Uniform Fire Code (UFC)	NFPA 50A NFPA 50B UFC CFC	

On first pass no specific or unique issues pertaining to hydrogen or hydrogen fueling stations were identified other than the item listed above. Good engineering practice, local codes, national recognized standards, etc. should all be followed, but the fact that this is a H2 station should not create any changes in the design, construction, installation, or operation of the station relating to this item. As additional people review the document and new things come to light, this section will be updated.

Instrument or Compressed Air (CA) – Used for valve actuation/air operated valves, electrical panel purge, etc. (CA should not to be used for purging of piping or equipment in hydrogen service. An inert gas such as nitrogen must be used for this.) Assumed source is an air compressor. Typical pressure is 100 to 150 psig.

Instrument N2 – Used for valve actuation/air operated valves, electrical panel purge, piping/equipment purging, etc. Assumed source could be from a liquid nitrogen system, membrane/generator, etc. Typical pressure is 100 to 150 psig.

H2 Gas Pipeline	**On Site Production, Reformer, Electrolyzer**						

Property / Land Use / Environmental	**On Site Production, Reformer, Electrolyzer**						
California Environmental Quality Act (CEQA)	Project size and location will determine if this applies. Obviously the bigger the project the greater the likelihood of triggering CEQA	Various	Often times if there is a state agency involved, they will take the lead on evaluating the possible CEQA impact. If there is no agency directly involved in the project, then typically it's the agency that's issuing a statewide permit (air pollution, water pollution, etc.) to the project.	Not sure?	Refer to the web site http://ceres.ca.gov/ceqa/	N/A	a) Negative Declaration if it finds no "significant" impacts; b) Mitigated Negative Declaration if it finds "significant" impacts but revises the project to avoid or mitigate those significant impacts; c) Environmental Impact Report (EIR) if it finds "significant" impacts.
California Accidental Release Program (CalARP). (California's answer to RMP)	Applies if storage of 10,000 pounds or more of hydrogen at the site.	CAL EPA?		Not sure?	Refer to website http://www.oes.ca.gov		Includes: Safety information, Hazard review, Operating procedures, Training, Maintenance, Compliance audits, and Incident investigation.

EPA,Risk Management Plan (RMP)	Applies if storage of 10,000 pounds or more of hydrogen at the site.	Not sure?	Federal EPA				
OSHA,Process Safety Management (PSM)	Applies if storage of 10,000 pounds or more of hydrogen at the site.	Not sure?	Federal OSHA				

Road Access, Traffic	**On Site Production, Reformer, Electrolyzer**						
Health & Safety Code	Handling of H2	Public Health Dept	Public Health Dept	Public Health Dept			
Calif Vehicle Code	Transport			Local Gov, Police, CHP	DOT, EPA		
Calif Environ Quality Act - CEQA	EIR		Local Planning Dept	Permitting Process		Local City Planning Guidelines	
	Transporting of flammable liquids or gases – Local regulated roads and bridges.						
	Transporting of flammable liquids or gases – State regulated roads, highways, bridges, tunnels.			California Highway Patrol (CHP)	DOT		
	Assume that delivery vehicle must be on private						

	property when off loading product. Can not be parked on a public street during off loading.						

California Code of Regulations Title 21 Section 1402.1(b) states that tank vehicles which are placarded "Flammable" under Department of Transportation (DOT) Regulations whether loaded or empty are not permitted on the Bay Bridge for example. "FLAMMABLE" is the proper placard for vehicles transporting materials with a hazard class of 3. Liquid Hydrogen has a hazard class of 2.1, the proper placard is "Flammable Gas". Therefore, it is believed that transporting liquid hydrogen across the Bay Bridge is permitted according to these regulations. This is probably an area where help and clarification will be needed.

Aesthetics / Special Zoning Requirements	**On Site Production, Reformer, Electrolyzer**						

It is believed that this will vary quite a bit from city to city, as well as the specific location that the station is at (for example if the area is zoned for commercial, light-industrial, heavy-industrial, etc.). Some cities have specific height restrictions, require screening to hide the equipment, noise restrictions if close to residential areas, etc. These issues are not specific to hydrogen only. This would apply to any industrials tanks, equipment, etc.

When the revised codes such as NFPA and IFC are published they will address underground storage of liquid hydrogen storage tanks as well as gaseous storage and equipment installation on the top of canopies.

On first pass no specific or unique issues pertaining to hydrogen or hydrogen fueling stations were identified. Good engineering practice, local codes, national recognized standards, etc. should all be followed, but the fact that this is a H2 station should not create any changes in the design, construction, installation, or operation of the station relating to this item. As additional people review the document and new things come to light, this section will be updated.

Acronyms:

OSFM – Office of the State Fire Marshal	NFPA – National Fire Protection Agency	DOSH – Department of Occupational Safety & Health
DSA – Department of the State Architect	DAS – Disability Access Section	CalOSHA – California Occupational Safety & Health Agency

W&M – Weights and Measures
AQMD – Air Quality Management District
UPS – Unified Program Section
DMV – Department of Motor Vehicles
BACT – Best Available Control Technology
PUC – Public Utilities Commission
APCD – Air Pollution Control District
HMBP – Hazardous Materials Business Plan
IAPMO – International Association of Plumbing and Mechanical Officials
PHA – Process Hazard Analysis
EIR – Environmental Impact Report
O/M – Operations and Maintenance
OES – Office of Emergency Services
RMP – Risk Management Plan
UL – Underwriter Laboratories
CARB – California Air Resources Board
CFC – California Fire Code
HMMP – Hazardous Materials Management Plan
OSHPD – Office of Statewide Health, Planning & Development
ASME – American Society of Mechanical Engineers
NIST – National Institute of Standards and Testing
HMIS – Hazardous Materials Inventory Statement
IEEE – Institute of Electrical and Electronics Engineers
HCD – Housing and Community Development
CUPA – Certified Unified Program Agency

C/S.2.b
Pressure Vessel Code

All national interested parties in the pressure vessel industry (vessel manufacturers, hydrogen gas suppliers, standards development organizations, jurisdictional authorities, etc.) will be initiating the standard development process for hydrogen pressure storage vessels on September 1, 2004 (after the posting of this draft report). The ASME Boiler and Pressure Vessel Project Team on Hydrogen Tanks will be meeting in New Orleans to discuss:

- Which Code should be used (VIII-1, 2 or 3)
- Code cases versus requirements in boiler pressure vessel code
- Limitations on existing Code rules
- Limitations on composite storage vessels
- Groundrules for new 15,000psi vessels, including:
    - Design margines
    - Design rules to calculate thickness for composite vessels
    - Design by analysis and confirmation by prototype tests
    - Fracture resistance (hydrogen effect and non-effect)
    - Limited design life of composite vessels
    - Inservice inspection and testing requirements
    - Post-construction guidance

The following document will serve as a place-holder in this report until the C/S.2.b sub-team reports back on the proceedings of the ASME meeting.

STATE OF CALIFORNIA Arnold Schwarzenegger, *Governor*

DEPARTMENT OF INDUSTRIAL RELATIONS
Division of Occupational Safety & Health
Pressure Vessel Unit
1515 Clay Street, Suite 1302
Oakland CA 94612-1402
Tel: (510) 622-3066 Fax: (510) 622-3063

August 2, 2004

To: All Interested Parties

Subject: Alternative Fuel Regulations

Our office has received numerous inquires from employers as to what the regulations are for the use of various alternative fuels, such as: compressed natural gas (CNG); liquefied natural gas (LNG); compressed hydrogen (H2); liquefied hydrogen (LH2); and liquefied petroleum gas (LPG). This letter will attempt to provide clarification.

The Division of Occupational Safety & Health (DOSH) is the state agency mandated to protect employees working in California. DOSH has a number of units that assist in this goal. The two that are most applicable are the CalOSHA Enforcement Unit and the Pressure Vessel Unit. The CalOSHA Enforcement Unit is typically referred to, as simply CalOSHA and most employers and employees are aware of its role in ensuring a safe working environment through investigating accidents and complaints. The Pressure Vessel Unit provides operating permits to employers using steam boilers, air tanks, and LPG tanks and supplying inspection services for other types of pressure vessels that do not require permits.

Employers are required to maintain their workplaces in compliance with the California Code of Regulations Title 8 (T8CCR). Copies of T8CCR may be purchased through Barclays at (800) 888-3600 or viewed on-line at http://www.dir.ca.gov/samples/search/query.htm. The Unfired Pressure Vessel Safety Orders are found in T8CCR Division 1, Chapter 4, Subchapter 1 and provide the regulations for CNG & LNG (Article 7), LPG (Article 5), and the Design and Construction of Pressure Vessels for other than Compressed Air, LPG, NH3, and Natural Gas (Article 2). Hydrogen regulations can be found in T8CCR Division 1, Chapter 4, Subchapter 7 Article 138. The scope section of each subchapter will determine the applicability of those regulations to your installation and the subchapters may also refer to other sections or standards that may apply.

While only LPG tank installations are the only alternative fuel that requires a permit to operate issued by the Pressure Vessel Unit, employers are still required to have their natural gas and hydrogen systems in compliance with the appropriate sections of T8CCR. The Pressure Vessel Unit can assist employers in complying with T8CCR by providing a consultation and on-site inspection at the employer's request, the results of which may be documented and supplied to the employer for their records.

There is also an acceptance process for those installations that do not strictly conform to T8CCR. The employer may petition the CalOSHA Standards Board to be granted a permanent variance from T8CCR by demonstrating that their installation is as safe or safer than one that complies with T8CCR. The variance process allows an employer to present information to the Standards Board at a formal hearing, after which, a decision will be made whether to grant the permanent variance or not. Application procedures will be supplied by the Standards Board, which may be contacted at (916) 274-5721.

A few technical questions have popped up consistently that need to be addressed. First, a change in Article 7 Section 527(c) in February 2003 required that LNG facilities use a methane gas detection system instead of odorization of the natural gas. The detection system shall be in the vicinity of the transfer operation and the vessel into which the gas was delivered and shall have both an audible and visible alarm device that signals when the methane airborne concentration exceeds 20% of the lower explosive limit. Another issue concerns the filling of LNG tanks. Article 7 Section 528(c) states that "To provide for the expansion of LNG with temperature, the tanks shall not be filled beyond the level specified by the tank manufacturer and in no case more than 90 percent." Article 7 Section 541(a)(6) requires that all CNG and LNG safety relief devices be tested annually. And finally, all pressure vessels used for the storage of these alternative fuels are required to be manufactured in accordance with the requirements of the American Society of Mechanical Engineers (ASME) Code, utilizing the appropriate section, unless specifically accepted by the DOSH Pressure Vessel Unit as equivalent to the ASME Code.

It is hoped that this information provides you with additional guidance as to what the current regulations are for the use of these alternative fuels in places of employment in our state. Please feel free to contact this office if you need further assistance or would like to have a consultation with one of our engineers. Our goal is to assist you in providing a safe working environment for your employees and to reduce the risk of an accident at your facility.

Sincerely;

Donald C. Cook
Principal Safety Engineer

C/S.2.c
Vehicle Interface

The Vehicle Interface consists of the dispensing unit that moves the fuel to the vehicle from its storage tank in the refueling station. It includes the refueling nozzle, hoses, valves, pumps, compressors and safety devices such as pressure relief devices and breakaway connections for nozzle hoses. It includes provisions for fuel quality including chemical composition, temperature, flow rate and pressure at the point of presentation to the vehicle.

Three forms of hydrogen refueling are encompassed in the following assessment: compressed gaseous hydrogen, liquid hydrogen, and blends of CNG and hydrogen. While the primary focus of initial hydrogen infrastructure deployment is expected to be compressed hydrogen to coincide with the majority of vehicles projected to be available for refueling prior to 2010, some vehicles using liquid hydrogen are also expected to be deployed. It is expected that fuel cell powered vehicles will operate on “pure” (~99%) hydrogen fuel, while vehicles with internal combustion engines (ICEs) tuned to operate on hydrogen blends may also be deployed. The dispenser equipment used for these three types of hydrogen refueling will be completely different and distinct.

H2 Highway: **C&S for Compressed H2** vehicle refueling interface *(DRAFT)*

Status: 8/11/04

Draft Standards		Applicable Released Standards		Recommendations:
		Gap Analysis Key:		
			= Gap requiring additional supporting documents for interim	
			= Gap which can utilize current release C&S until update is available	
			= No Gap: Applicable C&S already released	
CSA America				
CSA America HGV 4.1-	Compressed Hydrogen Dispensers			Utilize CaFCP* Fueling Interface Guideline/ STA until HGV Standards are Released
CSA America HGV 4.2-	Hoses and Hose Assemblies for Gaseous Hydrogen Vehicles and Dispensing Systems	**CSA America NGV 4.2-**	Hoses and Hose Assemblies for Gaseous Natural Gas Vehicles and Dispensing Systems	Components chosen must be Hydrogen compatible @ applicable pressure range
CSA America HGV 4.3-	Temperature Compensation Systems for Gaseous Hydrogen Vehicle Fueling Stations			Utilize CaFCP* Fueling Interface Guideline/ STA until HGV Standards are Released
CSA America HGV 4.4-	Breakaway Devices for Hoses Used in Compressed Hydrogen Vehicle Fueling Stations	**CSA America CNG 4.4-**	Breakaway Devices for Hoses Used in Compressed Natural Gas Vehicle Fueling Stations	Components chosen must be Hydrogen compatible @ applicable pressure range
CSA America HGV 4.5-	Priority and Sequencing Equipment for Gaseous Hydrogen Dispensing Systems	**CSA America CNG 4.5-**	Priority and Sequencing Equipment for Gaseous Natural Gas Dispensing Systems	Components chosen must be Hydrogen compatible @ applicable pressure range
CSA America HGV 4.6-	Manually Operated Valves Used in Gaseous Hydrogen Vehicle Fueling Stations	**CSA America CNG 4.6-**	Manually Operated Valves Used in Gaseous Natural Gas Vehicle Fueling Stations	Components chosen must be Hydrogen compatible @ applicable pressure range
CSA America HGV 4.7-	Standard for Automatic Pressure Operated Valves for Use in Gaseous Hydrogen Vehicle Fueling Stations	**CSA America CNG 4.7-**	Standard for Automatic Pressure Operated Valves for Use in Gaseous Natural Gas Vehicle Fueling Stations	Components chosen must be Hydrogen compatible @ applicable pressure range
CSA America HGV 4.8-	Hydrogen Gas Vehicle Fueling Station Compressor	**CSA America CNG 4.8-**	Natural Gas Gas Vehicle Fueling Station Compressor ***	Components chosen must be Hydrogen compatible @ applicable P & T range
CSA America HGV 2	Hydrogen Gas Vehicle Fueling Container	**CSA America CNG 2**	Natural Gas Gas Vehicle Fueling Container	Components chosen must be Hydrogen compatible @ applicable P & T range
CSA America PRD-1/ HGV	Pressure Relief Devices for Hydrogen Gas Vehicle (HGV) Fuel Containers	**CSA America PRD-1/ CNG**	Pressure Relief Devices for Natural Gas Gas Vehicle (CNG) Fuel Containers	Components chosen must be Hydrogen compatible @ applicable Temperature range
CSA America FC 5/ UL 2264	Hydrogen Generators Utilizing Fuel Processing Technologies			
Society of Automotive Engineers International				
SAE J2601	Performance requirements for the communications and refueling algorithms of a automotive gaseous and liquid hydrogen dispensers			Utilize CaFCP* Fueling Interface Guideline/ STA until SAE Standards are Released
SAE J2579	Recommended Practice for Fuel Systems in Fuel Cell and Other Hydrogen Vehicles	**SAE J2578**	Recommended Practice for General Fuel Cell Vehicle Safety	
SAE JXXXX	Hydrogen Quality Guideline for Automotive Applications (Standard number has not yet been issued)			Utilize CaFCP* H2 Quality Guideline & HQSA (H2 Quality Sampling Adapter) until SAE is published
SAE J2600	Metal Hydride Nozzles to be added by to the J2600. 700 Bar Completion	**SAE J2600**	COMPRESSED HYDROGEN SURFACE VEHICLE REFUELLING CONNECTION DEVICES (Metal Hydride Nozzles not covered)	Recommendation for Metal Hydride Nozzle direction to come from SAE working group
National Fire Protection Association				
NFPA 52**	Vehicular Fuel System Code 2005 (incoporates NFPA 57 as well)- CNG, LNG, LH2,CH2	**NFPA 50A**	Standard for Gaseous Hydrogen Systems at Consumer Sites	
NFPA 55	Standard for the Storage, Use and Handling of Compressed Gases and Cryogenic Fluids in Portable and Stationary Containers, cylinders, Equipment and Tanks (will also incorporate NFPA 50A & 50B)	**NFPA 50B**	Standard for Liquified Hydrogen Systems at Consumer Sites	
		NFPA 70	National Electrical Code Handbook	
International Codes Council (does not apply to CA)			**Does not apply to CA- Informational Only**	
ICC Model Building Code	Fuel Gas Code: Ch. 7 Gaseous H2 Systems, 632.1; 705; Mechanical Code: 924.1; FIRE CODE: General, 2209, 2211, 3204, 3205 (to be updated)	**ICC Model Building Code**	Fuel Gas Code: Ch. 7 Gaseous H2 Systems, 632.1; 705; Mechanical Code: 924.1; FIRE CODE: General, 2209, 2211, 3204, 3205	
American Standards and Testing Methods				
ASTM D03.14	Subcommittee for C&S on hydrogen and fuel cell vehicles (ASTM V3)- Standard Test methods and guidelines for gaseous (CNG,LNG,CH2) fuels		Various released standards for H2 impurity constituants	Utilize CaFCP* H2 Quality Guideline & HQSA (H2 Quality Sampling Adapter) until SAE is published
California Weights & Measures/ NIST				
		CA B&P Code Division 5	Fuel quality and performance (sections 13440, 13450) ASTM standard not available. Does not have juristiction over fuel cell vehicles.	Recommendation: CaFCP H2 Quality Guideline until SAE/ASTM document is ready
		CA B&P Code Division 5	Measurement of dispensed fuel (sections 12020, 12500, 12500.5, 12500.10, 12510) No standards for H2 for CA Weights and Measures. NIST standards and test procedures not available for hydrogen or blends.	Recommendation: CaFCP STA to be utlized in the interim in coordination with CA W&M / NIST. It is important to represent the spectrum of vehicle to insure safe, representative refueling.
California Air Resources Board (CARB)				
TBD	ARB not currently pursuing C&S regarding H2 Quality,etc. (awaiting industry lead)		Nothing applicable for H2 FCV (existing ICE engine standard would not be appropriate for FCV & ICE sharing station)	Utilize CaFCP* H2 Quality Guideline & HQSA (H2 Quality Sampling Adapter) until SAE is published
ISO (International Standards Organization)-not CA			**Does not apply to CA- Informational Only**	
TC-197	Hydrogen Quality Standard under ammendment in WG 12			

*** CaFCP Guidelines are planned to be approved internally at the end of October in the "Station Implementation Resource". CaFCP partner buyoff is required.**
**** Current standards for Hydrogen IC vehicles which cannot be utilized for H2 stations which have FCV (concerns of ICE values may degrades fuel cells / safety)**
STA = hydrogen Station Test Apparatus
HQSA = Hydrogen Quality Sampling Adapter
***** Some further investigation necessary**
****** NFPA 52 to be ballotted in October**

Critical Recommendations:

State of California should recommend that the California Air Resources Board changes the language on 2292.7 to incude "not including fuel cell vehicles"- next to Motor vehicles before the implementation of the H2 highway.

State of California should recommend that bureau of weights and measures to work with NIST and the California Fuel Cell Partnership to develop safe methodology for reviewing Hydrogen dispensers. The CaFCP has developed a hydrogen Station Test Apparatus (STA) in order to simulate vehicle fills to test station dispensers as well as a hydrogen quality sampling adapter for taking H2 quality samples off of the station dispenser.

H2 Highway: C&S for Hydrogen- CNG (HCNG) "Blend" vehicle refueling interface (DRAFT)

Status: 8/10/04

Draft Standards		Applicable Released Standards		Recommendations:
			Gap Analysis Key:	
			= Gap requiring additional supporting documents for interim	
			= Gap which can utilize current release C&S until update is available	
			= No Gap: Applicable C&S already released	
CSA America				
CSA America NGV 4.1-	Compressed Natural Gas Dispensers	**CSA America NGV 4.1-**	Compressed Natural Gas Dispensers	
CSA America NGV 4.2-	Hoses and Hose Assemblies for Gaseous Natural Gas Vehicles and Dispensing Systems	**CSA America NGV 4.2-**	Hoses and Hose Assemblies for Gaseous Natural Gas Vehicles and Dispensing Systems	Components chosen must be both H2 & CNG compatible
CSA America CNG 4.3-	Temperature Compensation Systems for Gaseous Natural Gas Vehicle Fueling Stations	**CSA America CNG 4.3-**	Temperature Compensation Systems for Gaseous Natural Gas Vehicle Fueling Stations	Standard should be established for the type and format of fuel HCNG
CSA America CNG 4.4-	Breakaway Devices for Hoses Used in Compressed Natural Gas Vehicle Fueling Stations	**CSA America CNG 4.4-**	Breakaway Devices for Hoses Used in Compressed Natural Gas Vehicle Fueling Stations	Components chosen must be both H2 & CNG compatible
CSA America CNG 4.5-	Priority and Sequencing Equipment for Gaseous Natural Gas Dispensing Systems	**CSA America CNG 4.5-**	Priority and Sequencing Equipment for Gaseous Natural Gas Dispensing Systems	
CSA America CNG 4.6-	Manually Operated Valves Used in Gaseous Natural Gas Vehicle Fueling Stations	**CSA America CNG 4.6-**	Manually Operated Valves Used in Gaseous Natural Gas Vehicle Fueling Stations	Components chosen must be both H2 & CNG compatible
CSA America CNG 4.7-	Standard for Automatic Pressure Operated Valves for Use in Gaseous Natural Gas Vehicle Fueling Stations	**CSA America CNG 4.7-**	Standard for Automatic Pressure Operated Valves for Use in Gaseous Natural Gas Vehicle Fueling Stations	Components chosen must be both H2 & CNG compatible
CSA America CNG 4.8-	Natural Gas Gas Vehicle Fueling Station Compressor	**CSA America CNG 4.8-**	Natural Gas Gas Vehicle Fueling Station Compressor	Components chosen must be both H2 & CNG compatible
CSA America CNG 2	Natural Gas Gas Vehicle Fueling Container	**CSA America CNG 2**	Natural Gas Gas Vehicle Fueling Container	Components chosen must be both H2 & CNG compatible
CSA America PRD-1/ CNG	Pressure Relief Devices for Natural Gas Gas Vehicle (CNG) Fuel Containers	**CSA America PRD-1/ CNG**	Pressure Relief Devices for Natural Gas Gas Vehicle (CNG) Fuel Containers	Components chosen must be both H2 & CNG compatible
CSA America FC 5/ UL 2264	Natural Gas Generators Utilizing Fuel Processing Technologies	**CSA America FC 5/ UL 2264**	Natural Gas Generators Utilizing Fuel Processing Technologies	Components chosen must be both H2 & CNG compatible
				CSA to provide a recommended nozzle geometry
CSA America PRD-1/ CNG	Pressure Relief Devices for Natural Gas Gas Vehicle (CNG) Fuel Containers	**CSA America PRD-1/ CNG**	Pressure Relief Devices for Natural Gas Gas Vehicle (CNG) Fuel Containers	Components chosen must be both H2 & CNG compatible
Society of Automotive Engineers International				
	No Standards for HCNG fuels		No Standards for HCNG fuels	
National Fire Protection Association				
NFPA 52	Vehicular Fuel System Code 2005 (incoporates NFPA 57 as well)- CNG, LNG, LH2,CH2. Present draft considers HCNGs with < 20% H2 equivalent to NG. (need to look at 30% HCNGs).	**NFPA 50A**	Standard for Gaseous Hydrogen Systems at Consumer Sites	NFPA 52 should be updated to include HCNG blend fuels above the percentage for natural gas. MM to give comments directly to NFPA
NFPA 55	Standard for the Storage, Use and Handling of Compressed Gases and Cryogenic Fluids in Portable and Stationary Containers, cylinders, Equipment and Tanks (will also incorporate NFPA 50A & 50B)	**NFPA 52**	Vehicular Fuel System Code 2005 (incoporates NFPA 57 as well) CNG, LNG, LH2,CH2. Present draft considers HCNGs with < 20% H2 equivalent to NG. (need to look at 30% HCNGs).	
		NFPA 70	National Electrical Code Handbook	
International Codes Council (do not apply to CA)				
				Requested Feedback from ICC
American Standards and Testing Methods				
	A means should be established to confirm and monitor that the stated HCNG rate is being achieved.		Various released standards for natural gas impurity constituants	Request Feedback from ASTM
California Weights & Measures/ NIST				
		CA B&P Code Division 5	Fuel quality and performance (sections 13440, 13450) ASTM standard not available.	Current Standards Not Applicable to HCNG Fuels. Fills involving both H2 & NG require fill rate limitation (CNG fills generally do not). The fill rate for HCNG blend fuels may require fill rate limitation. We require a rationale for determining the flow rate limit and a means to verify and monitor it ***Collect Data for developing of Weights & Measure Protocols***. See below.
		CA B&P Code Division 5	Advertising signage (sections 13531, 13532) Only applicable to fuels intended for ICE vehicles	
		CA B&P Code Division 5	Dispenser labelling (sections 13470, 13480) Only applicable to fuels intended for ICE vehciles	
		CA B&P Code Division 5	Measurement of dispensed fuel (sections 12020, 12500, 12500.5, 12500.10, 12510) No standards for H2 for CA Weights and Measures. NIST standards and test procedures not available for hydrogen or HCNGs.	
California Air Resources Board (CARB)				
	TBD			Not Applicable to HCNG Fuels. Collect Data.
ASME				
		B 31.3	Code on Process Piping	Components chosen must be both H2 & CNG compatible
ISO (International Standards Organization)-not CA			**Does not apply to CA- Informational Only**	
TC-197	Work item 15869- Land vehicle filling connectors 20012 Gaseous H2 and hydrogen HCNGs- fueling stations			

Critical Recommendations:

Recommend to the state that it catalyzed the CSA America and relevant SDOs and the US DOE to craft a standard for HCNG %guidelines.
Issue 1: It is necessary to determine the maximum % of H2 below which could be considered natural gas.
Issue 2: Also recommend that the state encourage to the SDOs develop a standard % range of H2 blend into CNG

State of California: Recommend that the state find appropriate groups to develop an interim percentage range HCNG standard while encouraging SDOs to develop a more perminant % range standard. In addition, it is recognized that ISO TC 197 Working group has completed draft standards for HCNG blend fuels. It is recommended to set up an official contact in order to see if it is possible to utilize these draft standards in California.

State of California should recommend that bureau of weights and measures adopt methods and standards to measure HCNG fuel fill rate limitations and HCNG fuel percentages.

H2 Highway: C&S for **Liquid H2 vehicle** refueling interface *(DRAFT)*

Status: 8/09/04

Draft Standards		Applicable Released Standards		Recommendations:
		Gap Analysis Key:		
			= Gap requiring additional supporting documents for interim	
			= Gap which can utilize current release C&S until update is available	
			= No Gap: Applicable C&S already released	
CSA America				
	CSA is not currently doing work in LH2			
Society of Automotive Engineers International				
SAE J2600	LH2 Nozzle addition			Utilize BMW/ GM LH2 Fueling Interface Protocoll until SAE Standard Published
SAE J2601	Performance requirements for the communications and refueling algorithms of a automotive gaseous and liquid hydrogen dispensers			Utilize BMW/ GM LH2 Fueling Interface Protocoll until SAE Standard Published
SAE J2579	Recommended Practice for Fuel Systems in Fuel Cell and Other Hydrogen Vehicles	**SAE J2578**	Recommended Practice for General Fuel Cell Vehicle Safety	
SAE JXXXX	Hydrogen Quality Guideline for Automotive Applications (Standard number has not yet been issued)			Utilize released LH2 Guideline
National Fire Protection Association				
NFPA 52	Vehicular Fuel System Code 2005 (incoporates NFPA 57 as well)- CNG, LNG, LH2,CH2			
NFPA 55	Standard for the Storage, Use and Handling of Compressed Gases and Cryogenic Fluids in Portable and Stationary Containers, cylinders, Equipment and Tanks (will also incorporate NFPA 50A & 50B)	**NFPA 50B**	Standard for Liquified Hydrogen Systems at Consumer Sites	
		NFPA 70	National Electrical Code Handbook	
International Codes Council (do not apply to CA)				
ICC Model Building Code	Fuel Gas Code; Ch. 7 Liquid H2 Systems:	**ICC Model Building Code**	Fuel Gas Code; Ch. 7 Liquid H2 Systems:	
American Standards and Testing Methods				
ASTM D03.14	Subcommittee for C&S on hydrogen and fuel cell vehicles (ASTM V3)- Standard Test methods and guidelines for gaseous (CNG,LNG,CH2) fuels		Various released standards for H2 impurity constituants	
California Weights & Measures/ NIST				
TBD	Both California & NIST working on standard for weights & measures		Nothing applicable for H2 FCV	Collect Data for developing of Weights & Measure Protocols
California Air Resources Board (CARB)				
TBD	ARB not currently pursuing C&S regarding H2 Quality,etc.		Nothing applicable for H2 FCV	Coordinate with weights and measures
ISO (International Standards Organization)-not CA				
TC-197	Hydrogen Quality Standard			

Critical Recommendations:

State of California should recommend that bureu of weights and measures should investigate and develop measurement protocols

State of California should recommend that ARB to coordinate with Weights and Measures/ NIST

C/S.2.d
Stationary

Energy Station Concept

The end goal of the California Hydrogen Highway is to develop an economically viable fueling infrastructure for the hydrogen vehicles California expects on the road over the next 10-15 years. Hydrogen stations can be as simple as dispensing systems for stored hydrogen or more complex systems that generate hydrogen onsite to dispense as vehicle fuel. One system concept would generate hydrogen on-site and use the hydrogen for either vehicle fuel or for power generation in a stationary fuel cell – the "energy station". This paper looks to analyze the framework, validity/viability, and actual value of implementing this concept as part of the Ca H2 Highway.

Given the few numbers of hydrogen vehicles in the foreseeable future, the Hydrogen Highway envisioned will have much greater capacity than there will be required to refuel the available hydrogen vehicles. This is expected to change after 2010 – but until then the early-deployed hydrogen stations will have underutilized capacity. Energy stations are seen as a means to fully utilize on-site hydrogen generating capacity by generating electricity and either offsetting grid purchase of electricity for a customer or selling electricity to the grid. In either situation, electricity from fuel cells needs to be competitive with retail purchase of conventional power or wholesale power prices if sold to the grid. For the energy station to "improve" the economics of a hydrogen station, it must provide electricity at less cost than the grid, and/or profitable revenue in sold power to the grid. Ultimately, the objective of the Hydrogen Highway Initiative is to maximize the value and at the same time minimize the investment in the fueling infrastructure system.

For the last 4 years in California, under a California Public Utilities Commission (CPUC) program that was requested by the legislature, $125 million per year in incentives have been available for distributed generation. Incentives as high as $4,500/kW (for projects up to 1MW) are allocated for renewable sources of electricity that includes photovoltaics, wind turbines, and fuel cells operating on renewable fuel. Incentives of $2,500/kW are available for fuel cells operating on non-renewable fuel (e.g. natural gas) utilizing waste heat recovery. Conventional cogeneration/ICE generation is eligible for $1,000/kW incentives. To date there have only been about five fuel cell projects that have applied for these incentives – potentially indicating that the technology in either cost, performance, or reliability is not cost effective when compared to conventional technologies.

Certainly in the future, stationary fuel cells will have lower cost, better reliability, and provide the economic benefits needed to compete in the market against traditional sources of power generation.

The economics of a variety of applications of hydrogen-fueled stationary power generation are being analyzed and assessed by the California Hydrogen Highways' Economy Topic Team, which functions in parallel to this Implementation Team. Some of the issues considered in that effort include the following:

Achieving competitive economics will depend upon achieving significant cost reductions for fuel cells and identifying a much lower cost of hydrogen. While the total installed cost of fuel cells in $/kw has long been a known issue, hydrogen costs can be a more significant issue in term of cost per kilowatt hour of electricity. As an example, a hydrogen cost of $4/kg translates into a electricity cost of 20-25 cents per kilowatt hour – without counting the capital cost or operating cost of the system. In the near term, stationary fuel cells are having a difficult time competing with conventional sources, even with the heavy subsidies offered by utilities. While stationary fuel cells should certainly be included in the mix of concepts adopted by the Hydrogen Highway, they perhaps should not be the dominant technology incorporated into the majority of stations planned for the highway.

Where an existing stationary system is planned, either as a demonstration or deployment, it may be beneficial to utilize excess capacity for the stationary power where this capacity represents a marginal fraction of the production capability, and the production capability needed to achieve it does not affect the cost of the system.

Current analysis indicates that the cost minus the return of utilizing potential excess hydrogen capacity by adding a PEM fuel cell to use this capacity is a financial loss vs. underutilizing components of a dedicated hydrogen refueling station. It is also unclear how long the excess hydrogen generating capacity may be present. While the long-term economics of PEM fuel cells may improve, this will be paralleled by an increase in their automotive use, and consequently an increase in hydrogen demand. [if hydrogen capacity is used by vehicles – this will eventually lead to the fuel cell being a stranded asset??][5]

Further complicating the issue is the fact that most of the "large" stationary fuel cells intended to operate continuously are high temperature and may internally reform natural gas, thus bypassing the need for hydrogen reformation capacity. Additionally, peak hydrogen utilization for vehicles is expected to be greatest during the normal business hours when people commute or drive for work. If hydrogen generation is needed to maintain station capability, additional storage will be required, but this appears unfavorable for the economics of the station, even when optimistic swings in peak/off-peak grid electricity rates are considered. Currently, refueling stations do not provide backup for grid power interruptions to provide for uninterrupted vehicle refueling. Should that capability be incentivized as a public value to decouple grid failures from transportation impacts, which would change station economics for stationary power generation.

For long term permanent facilities, feedstock or hydrogen delivery means and capacity will need to be established. For semi-permanent or temporary stations deployed to meet early needs, the excess cost and potential regulatory burden of supplying larger quantities of the feedstock or hydrogen (thus requiring different modes of delivery) may also pose economic and implementation challenges. Code compliance for issues for

[5] **Comment (Chernicoff):** Issue is that it seems that the only way tying into stationary fuel cells is if the fueling station components are a small fraction of the total hydrogen consumption, however, fuel cell DG isn't and won't be economically viable except in specialized cases, such as where uninterruptible power is critical, but these places don't tend to have fueling stations located next to them.

siting the individual systems, (grid power, and fueling) pose significant challenges, particularly at this early stage. Combining the two systems complicates matters and creates code approval issues that have very little precedent.

Each station must be evaluated on its own merits. Urban stations, targeted as the priority for first deployment, are space-constrained. However, rural stations along major corridors may exhibit greater opportunities for the energy park concept.

The CPUC is planning to continue the incentive program for distributed power generation for another three years. As fuel cell manufacturers improve their product and economics, more fuel cells should be installed in the future, and greater consideration for energy stations should be given as the overall economics improve. In terms of the near-term issue of defining codes and standards for fuel cell installations, a large focus on stationary fuel cells to enhance hydrogen station profitability does not seem warranted.

This paper does not consider configurations and scenarios where electricity co-generation could make economic sense:

1. *Use of hydrogen ICE gen-sets for electricity generation instead of fuel cells will substantially improve economics.*
2. *In the case of on-site electrolysis hydrogen production, electricity generation option for station's own consumption rather than for connection to grid would result in savings on electricity bill during peak hours. Note: extra storage capacity will be required that will be (or won't be) justified depending on the difference between off-peak and peak electricity prices. Electrolysis based stations could also take non-guaranteed off-peak electricity that will make peak shaving even more appealing.*
3. *Added bonus: Savings on an emergency back-up power system that should be factored in overall economics considerations.*

Also, from C&S prospective, installation of extra gensets for internal electricity generation within the perimeter of a refueling station will not represent any additional problem except would require more space. That space, however, would be equivalent to the one required for an emergency back-up power system.

C/S.2.e
Clearance Distances

Several Standards Development Organizations (SDO's) and model Code Development Organizations (CDO's) are working with the federal government, state governments, and industry to develop Codes and Standards that would provide a basis for assurance of public safety and for permitting hydrogen refueling stations.. Consequently, the relevant Codes and Standards are evolving and subject to further change. It would be helpful if the State of California would develop templates and/or how-to-manuals that provide guidance to those who need to install hydrogen refueling stations. These templates and/or how-to-manuals should be flexible enough to stay current with the rapidly changing Code and Standards and regulatory environment.

It is also recommended that the State of California develop and collaborate with the U.S. DOE Hydrogen - Fuel Cells and Infrastructure Technologies Office that is developing permitting templates and supporting R&D to provide comprehensive and sufficient information as the basis for Codes and Standards for a hydrogen fuel infrastructure and hydrogen-fueled vehicles. Templates of Codes and Standards and Regulations developed by SCAQMD for a number of South Coast regions should be coordinated with the U.S. DOE umbrella activity.

The DOE effort includes development of software that shows the layout of a typical fueling station with the current setback requirements in the International Fire Code. The program allows the user to step through the ICC requirements that affect the footprint of a fueling station, for example, the setbacks for dispensers, signs, and storage tanks. The next generation of this program will be linked to a flexible database that will, for example, contain setback requirements of the NFPA and other requirements of state and local authorities having jurisdiction that could affect station footprint. DOE plans to further develop the software and database to assist code officials and industry create a set of footprints that can serve as starting points for locating hydrogen fueling stations in, for example, urban, suburban, and rural areas of California where CHH stations may be located.

The California Hydrogen Highway Network will provide a valuable opportunity for state and federal collaboration on hydrogen fueling infrastructure development not only in the implementation stage but also in its evolution. To that end, participants should be encouraged to provide information on performance, reliability, durability and any safety issues to the DOE program so that a statistically significant database can be assembled to competently guide broader deployment of hydrogen infrastructure with confidence in its safe and reliable performance.

C/S.2.f
Field Certification

Equivalence to Listed components

California Code of Regulations - Hydrogen

The present California Code of Regulations for hydrogen systems link is below. H_2 fueling stations are not covered.

http://www.dir.ca.gov/Title8/sb7g20a138.html **=**

This is also NFPA 50A. A reference to H_2 fueling stations referring to NFPA 52 2005 needs to be added.

NFPA 52 Wording

1.4 Alternate Provisions.
It is recognized that advancements in technology and improvements in system design and equipment can result in equipment fabrication methods, component design requirements, and installation and operating practices that differ from those specified in this code. Such deviations or improvements can provide equivalent safety and compatible operation that meet the intent of this code. Such deviations shall be permitted where the authority having jurisdiction has seen evidence that a special investigation of all factors has been made and, based on sound experience and engineering judgment, has concluded that the proposed deviations meet the intent of this code.

2005 draft proposed additional wording:

Designers, fabricators, engineers and constructors of LNG and LGH2 fueling facilities shall be competent and have expertise in the design, fabrication, and construction of LNG and LGH2 containers, cryogenic equipment, loading and unloading systems, fire protection equipment, Gas detection, siting, containment, piping systems, and other components of the facility. Supervision shall be provided for the fabrication, construction, and acceptance tests of facility components to the extent necessary to ensure that facilities are structurally sound, suitable for the service, and otherwise in compliance with this code. (57)

A.3.2.2 Authority Having Jurisdiction (AHJ). The phrase “authority having jurisdiction,” or its acronym AHJ, is used in NFPA documents in a broad manner, since jurisdictions and approval agencies vary, as do their responsibilities. Where public safety is primary, the authority having jurisdiction may be a federal, state, local, or other regional department or individual such as a fire chief; fire marshal; chief of a fire prevention bureau, labor department, or health department; building official; electrical inspector; or others having statutory authority. For insurance purposes, an insurance

inspection department, rating bureau, or other insurance company representative may be the authority having jurisdiction. In many circumstances, the property owner or his or her designated agent assumes the role of the authority having jurisdiction; at government installations, the commanding officer or departmental official may be the authority having jurisdiction.

A.3.2.4 Listed. The means for identifying listed equipment may vary for each organization concerned with product evaluation; some organizations do not recognize equipment as listed unless it is also labeled. The authority having jurisdiction should utilize the system employed by the listing organization to identify a listed product.

A.3.2.1 Approved. The National Fire Protection Association does not approve, inspect, or certify any installations, procedures, equipment, or materials; nor does it approve or evaluate testing laboratories. In determining the acceptability of installations, procedures, equipment, or materials, the authority having jurisdiction may base acceptance on compliance with NFPA or other appropriate standards. In the absence of such standards, said authority may require evidence of proper installation, procedure, or use. The authority having jurisdiction may also refer to the listings or labeling practices of an organization that is concerned with product evaluations and is thus in a position to determine compliance with appropriate standards for the current production of listed items.

International Code Council
Fuel Gas Code

105.2 Alternative materials, methods and equipment. The provisions of this code are not intended to prevent the installation of any material or to prohibit any method of construction not specifically prescribed by this code, provided that any such alternative has been approved. An alternative material or method of construction shall be approved where the code official finds that the proposed design is satisfactory and complies with the intent of the provisions of this code, and that the material, method or work offered is, for the purpose intended, at least the equivalent of that prescribed in this code in quality, strength, effectiveness, fire resistance, durability and safety.

International Code Council
Fire Code

104.9 Alternative materials and methods. The provisions of this code are not intended to prevent the installation of any material or to prohibit any method of construction not specifically prescribed by this code, provided that any such alternative has been approved. The fire code official is authorized to approve an alternative material or method of construction where the fire code official finds that the proposed design is satisfactory and complies with the intent of the provisions of this code, and that the material, method or work offered is, for the purpose intended, at least the equivalent of that prescribed in this code in quality, strength, effectiveness, fire resistance, durability and safety.

Nationally Recognized Testing Laboratories

http://www.osha.gov/dts/otpca/nrtl/index.html

Type of Products Requiring NRTL Approval

NRTLs are qualified private organizations that meet the requirements in OSHA regulations under 29 CFR section 1910.7 to perform independent safety testing and product certification. OSHA makes this determination under its NRTL Program, which is part of OSHA's Directorate of Science, Technology, and Medicine.

NRTLs may be based in the United States or in other countries. Currently, 16 NRTLs are established in the United States, and 2 NRTLs are foreign-based. A listing of current NRTLs is at http://www.osha-slc.gov/dts/otpca/nrtl/nrtllist.html. The recognition process (described under section 1910.7) is the same for all organizations; however, if an applicant is foreign-based, OSHA must consider the policy of the foreign government concerning its acceptance or recognition of test labs and NRTLs based in the United States. Such acceptance is not a prerequisite for OSHA to grant the applicant recognition.

The term "NRTL" may be a little misleading. It not only means that an organization must be a test lab that performs product safety testing. In addition, OSHA requires the same organization to operate a product-certification program that includes listing and labeling and follow-up inspection programs. For a particular product, safety testing activities involve the NRTL ensuring that a representative unit of that product has necessary safety features.

The related certification activities involve the NRTL ensuring, again for that particular product, that all manufactured units of the product have the necessary safety features. Proper product testing and certification require a great deal of special expertise, effort, and resources. OSHA does not perform any product approvals; OSHA relies on third parties, NRTLs, to do this work.

Most of OSHA's standards that require NRTL approval are found in the Agency's General Industry standards, in 29 CFR Part 1910. For example, 29 CFR 1910.303(a) (read together with the definitions of "approved" and "acceptable" in §1910.399) imposes a general requirement for electrical equipment or products to be approved by NRTLs. The term most often used in the standards to require NRTL approval is the term **approved**. Terms in those standards having similar meaning include **certified**, **listed**, and **listed and labeled**. A comprehensive listing of NRTL approval requirements can be found on OSHA's web site at http://www.osha.gov.

Similar provisions for third party approval of products exist to varying degrees in other OSHA standards. OSHA's Construction Standards, 29 CFR Part 1926, requires that approval of electrical equipment be provided by a "qualified testing laboratory" (QTL). OSHA's definitions for NRTLs and QTLs are essentially equivalent.

A Few Minor Exceptions

In general, under 29 CFR Part 1910, products required to be approved must be NRTL

approved. However, there are a few exceptions. Most notably, for electrical products, there are two exceptions. If the electrical products are of a kind that **no NRTL approves**, then OSHA allows approval of the products by a Federal agency or by a State or local code authority that enforces NEC workplace safety provisions. The other exception concerns "custom-made equipment," which designates equipment designed, made for, and used by a particular customer (i.e., unique or one-of-a-kind items). In this case, the employer must demonstrate safety based on test data provided by the manufacturer. As can be seen, these exceptions are very narrow.

As indicated earlier, NRTLs can use testing done by other parties under certain programs allowed by OSHA. These other parties include product manufacturers and can be located anywhere in the world. While using these programs can minimize the work that the NRTL must accomplish itself, the NRTL must exercise adequate control to ensure that other parties are doing the activities appropriately. Nonetheless, these programs can reduce the time and cost necessary for product certification.

"CE" Mark and Foreign Testing Organizations

The CE mark is a generic marking allowed by the European Union (EU) to indicate that a product meets requirements in the EU for product safety and is unrelated to the requirements for product safety in the United States. In the United States, a product used in the workplace that is required to be NRTL approved must have the specific mark of one of the NRTLs that is recognized to test and certify this type of product. For this reason, OSHA must recognize a foreign testing and certification organization as an NRTL before its product certifications will be considered acceptable to OSHA.

From http://www.osha.gov/dts/otpca/nrtl/prodcatg.html

The following categories of materials/equipment (products) are required to be approved by a NRTL, per provisions of the General Industry Standards (Part 1910 of Title 29, Code of Federal Regulations - 29 CFR Part 1910). Materials/equipment that are similar in type are grouped together. **NOTE: APPROVAL OF THE MATERIALS OR EQUIPMENT MAY BE REQUIRED ONLY UNDER SPECIFIC CIRCUMSTANCES OR CONDITIONS OF USE. REVIEW THE SPECIFIC REFERENCES TO NRTL APPROVAL TO DETERMINE IF ANY SPECIFIC CIRCUMSTANCE OR CONDITION APPLIES TO THE APPROVAL OF ANY EQUIPMENT LISTED BELOW.**

1. Electrical conductors or equipment (Subpart).

2. Automatic sprinkler systems.
3. Fixed extinguishing systems (dry chemical, water spray, foam, or gaseous agents).
4. Fixed extinguishing systems components and agents.

5. Fire detection device for automatic actuation of total flooding system.
6. Portable fire extinguishers.
7. Automatic fire detection devices and equipment.
8. Employee alarm systems.

9. Self-closing fire doors (openings to inside storage rooms for flammable or combustible liquids).
10. Fire doors [1 ½ hour (B) rated] (openings, to other parts of a building, of storage rooms for liquefied petroleum gas (LPG)).
11. Metal frame of windows in partitions of inside acetylene generator rooms used in oxygen-fuel welding and cutting.

12. Heat actuated (closing) devices (dip tanks containing flammable or combustible liquids).

13. Self-closing fire doors (including frames and hardware) used in openings into an exit.

14. Flame arresters, check valves, hose (transfer stations), portable tanks and safety cans - (flammable/combustible liquids).
15. Pumps and self-closing faucets (for dispensing Class I liquids).
16. Flexible connectors (piping, valves, fittings) - (flammable liquids).

17. Service station dispensing units (automotive, marine).
18. Mechanical or gravity ventilation systems (automotive service station dispensing area).
19. Automotive service station latch-open devices for dispensing units.

20. New commercial and industrial LPG consuming appliances.
21. Flexible connectors (piping,valves, fittings) - LPG.
22. Powered industrial truck LPG conversion equipment.

23. LPG storage and handling systems (DOT containers, cylinders).
24. Automatic shut-off devices (portable LPG heaters including salamanders).
25. LPG container assemblies (non-DOT) for interchangeable installation above or under ground.

26. Fixed electrostatic apparatus and devices (coating operations).
27. Electrostatic hand spray apparatus and devices.
28. Electrostatic fluidized beds and associated equipment.

29. Each appurtenance (e.g., pumps, compressors, safety relief devices, liquid-level gaging devices, valves and pressure gages) in storage and handling of anhydrous ammonia.

30. Gasoline, LPG, diesel, or electrically powered industrial trucks used in hazardous atmospheres.

31. Acetylene apparatus (torches, regulators or pressure-reducing valves, generators [stationary and portable], manifolds).
32. Acetylene generator compressors or booster systems.
33. Acetylene piping protective devices.
34. Manifolds (fuel gas or oxygen) - separately for each component part or as assembled units.

35. Scaffolding and power or manually operated units of single-point adjustable suspension scaffolds.
36. Hoisting machine and supports (Stone setters' adjustable multiple-point suspension scaffold).
37. Hoisting machines (Two-point suspension scaffolds; Masons' adjustable multiple-point suspension scaffold.

Underwriter’s Laboratory

FIELD EVALUATION SERVICE – A UL service for evaluating an installed product that has not been previously investigated by UL, or for a UL Listed product that has been modified in the field. Field evaluations are limited to the features and characteristics that can be evaluated at the installed site without damage to the product.

Risk Assessment & Management

RA/M.1 – Insurance
RA/M.2 – Public Safety & Risk Assessment

RA/M.1
Insurance

This deliverable will include recommendations to make it easier for hydrogen fueling station providers to procure insurance.

RA/M.2
Public Safety and Risk Assessment

Risk Assessment and Management Sub-team

To insure adequate risk assessment and management (RA/M), all groups planning to build hydrogen fueling stations should include specific elements related to RA/M in their permitting submittals. The table below lists these recommended elements, their purpose, and the group or agency that should review that element. In some cases the specific element may be new to the reviewing group; therefore, training and review tools should be provided to aide the process. In some cases the RA/M element is necessary only until proper codes and standards are in place for hydrogen fueling stations. We recommend dropping those elements when the appropriate C&S are adopted.

Additional RA/M Recommendations:

- Create an Emergency Strike Team to investigate hydrogen fueling station accidents and incidents. The Team would prepare reports that would be available to the hydrogen community. The reports would identify specific actions that would increase fueling station safety.
- Require certification of all hydrogen fueling station maintenance providers.
- Require annual maintenance inspections of critical fueling station hardware and systems. This requirement should be periodically revisited when more station data is available.
- All hydrogen stations that meet all applicable codes and standards should be classified as CEQA 70 – Categorically Exempt (CE).
- State should champion idea that hydrogen stations should be allowed wherever (and perhaps beyond) gasoline is allowed.

RA/M Element	Purpose	Reviewed By	Tools to Evaluate	Relax when
Site Quantitative Risk Assessment (QRA)	Measures selected site risk (hazard extent + frequency)	Fire Marshal's office (primary); Zoning (secondary)	Published State guidelines of acceptable risk; Training for reviewers	State adopts sufficient C&S (e.g. NFPA 52, NFPA 55, etc). Require if exceptions to C&S
HazOp	Detailed design review process to ensure safe design and operation	Fire Marshal's office (primary)	Node analysis tables/drawings; Training for reviewers	State adopts sufficient C&S (e.g. NFPA 52, NFPA 55, etc). Require if exceptions to C&S
Emergency Response Plan	Detailed plan for execution should an emergency incident occur	Fire Marshal's office (primary)	Training for reviewers; State standard elements	Continuous requirement
Control / Recovery Register	Details overall project (site + equipment + operations) measures	Fire Marshal's office (primary)	Training for reviewers; State standard elements	State adopts sufficient C&S (e.g. NFPA 52, NFPA 55, etc). Require if exceptions to C&S
Insurance	Provides financial protection	State or local agency	State standards	Continuous requirement
First Responder Training	To mitigate impact from incidents that may occur	State or local agencies	State standards	Continuous requirement
Operation Inspections	To enforce safe operations and compliance to C&S	Fire Marshal's office; Weights/Msrs; other	Training; Standards; checklists	Continuous requirement